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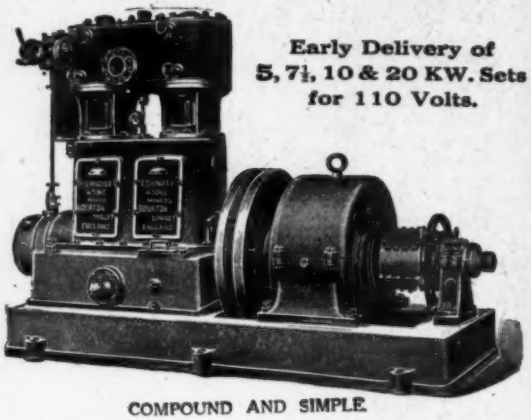

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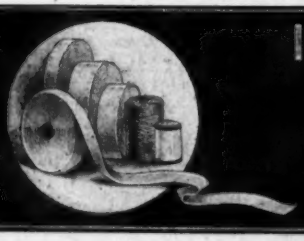

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ELECTRICAL REVIEW.

VOL. LXXXVIII. JUNE 24, 1921. No. 2,274

ELECTRICAL REVIEW.

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THE TRADE BAROMETER.

THOUGH the signs on the horizon of improvement of the world trade situation may appear little larger than a man's hand, it is a matter for gratification that they exist at all. It is believed by some that the worst stage has been passed through, and that with the gradual restoration of confidence between all peoples and the improvement of relations between all the different classes engaged in industry we shall make progress toward better things.

We write at a moment when little is known as to the effect of the ballot of the miners against resuming work on the offered terms, and while the ballot of the engineering workers regarding the employers' modified proposals is being taken, but we have little fear of the ultimate result in these matters if it is recognised that the future existence of these industries is at stake and that decreased costs and greater production are vital if the sacrifice of British export trade is to be prevented. In various districts the pits are being opened for the men to return to work at revised terms if so inclined, and we believe that the strike will gradually fail—or perhaps suddenly, judging from the tone of the speech delivered by Mr. Hodges on Tuesday. It is stated that in certain parts of the United Kingdom there is a more satisfactory booking of engineering trade orders in contemplation of a renewal of fuel supplies as the miners drift back to work. In this department of industry as well as in the iron and steel trade it is anticipated that orders will come in far more rapidly as purchasers can feel that lower prices are at hand; one Press report from Sheffield says that high-speed steel makers are anticipating something like a revival of trade in the autumn.

Turning to the electrical branches of trade, several encouraging reports have been issued lately. In that published by Callenders' Cable Co. reference is made to the happy relations that have been brought into being between the company and its employés. The reason for this optimism is that a satisfactory arrangement has been completed on a sliding-scale basis with the workpeople at Erith and Leigh, which it is confidently anticipated will prevent labour disputes in future. The cost of production has made it more difficult for the company to compete in several foreign and overseas markets, but it is hoped that the reduced prices of raw materials now obtaining and the recent arrangement with regard to labour will enable the company to restore its foreign trade connections to that leading position which, as our readers are well aware, it occupied for so long a period. That those responsible for the control of the concern are not content with the mere expression of pious hopes that improvement will turn up, but are willing to make worthy efforts to secure the fulfilment of such hopes, is shown by the fact that Sir T. O. Callender, the managing director, has during recent months paid a visit to India, where he has been strengthening the position of his company's interests. In our opinion, those of our manufacturers who are alert and observant in the overseas markets and are willing personally or by worthy deputy to visit prospective trade centres, in spite of the state of affairs at home, are not only doing a good thing for themselves and their shareholders, but are rendering most valuable service to the nation by preparing employment for thousands of workpeople for

years to come. The Callender agents are active in Australia and South Africa, and are securing large orders, while the South American market, with all its great opportunities, has amply justified, by the orders secured, the recent opening of a branch there. Unsettlement generally and exchange disparities have hampered activity in the Near East, but even here Sir Tom Callender looks forward to a resumption of the Continental business at no distant date. It is not possible to compete with the German on the Continent now, but in his opinion this state of things is not going to continue. It is distinctly encouraging to note his reference to the general increase of business, enabling him and his co-directors to approach the remainder of the year with confidence.

The chairman of the Electric Construction Co., Ltd., in a speech which we reported last week, remarked that in the electrical industry the number of inquiries for plant and apparatus indicated that there was a large amount of work waiting to be done, but buyers were holding their hand in the expectation of a fall in prices. He also said that before the country could recapture its export business or meet foreign competition, lower costs of production were essential. He further alluded to the crushingly heavy burden of taxation which has to be borne by our manufacturers, far more onerous than the burden carried by the foreign manufacturers with whom we are in competition. It seems ridiculous that those who are reported to have won the war against Militarism should also have to labour under so severe a handicap from taxation, directly or indirectly, caused by the war.

We may quote one other leading manufacturer's opinion regarding the situation, namely, that of Mr. H. C. Levis, who at the meeting of the British Thomson-Houston Co., Ltd., after referring to the large volume of orders with which the company started out upon the year 1921, said that the depression with which 1920 ended had continued into 1921, but he could not help feeling that there would be a revival of trade soon after the present strikes were settled. His reason for so thinking was that the number of important inquiries that they were receiving was large. Inquiries indicated contemplated purchases, and there was a great shortage of electrical machinery which must be made up when prospective purchasers were in a better position to finance their requirements.

Next week a meeting of the International Chamber of Commerce is being held in London, to which America is sending 50 delegates, and the chief business is the consideration of the means for the restoration of the world's trade. No doubt a great deal of discussion, of some value, will take place, but the first thing that is essential if United Kingdom industries and trade are to get into satisfactory operation again, is the termination of the miners' and the engineering disputes in such a way as to bring a measure of contentment and a determination to gain a victory over adversity.

The London Electricity Inquiry.

Very early in the course of the inquiry opened last week, it was made clear that the proposal to erect superstations for the supply of electricity to the London area had receded into the distant future, as foreshadowed in our columns. The excessive capital charges have brought about this result. Further, the idea of closing certain existing stations has also been abandoned, for the present, and we are left with nothing but a scheme for linking-up existing generating stations, and adding to the plant in a good many of them, to a total of a quarter of a million kilowatts in all. This stage of development is estimated to last for the next five years, when, after deducting obsolete plant removed from the stations, there would be a total of 557,000 kW to meet a demand of 480,000 kW, with some 75,000 kW in reserve in the smaller and less efficient stations. The whole of the generating plant would be operated under the control of the Joint Electricity Authority at a cost of £50,000 a year. The linking-up mains would cost a million sterling, and the total outlay by the Authority would be £1,050,000 during the first five years (this obviously does not include the cost of new generating plant). The Authority would take over the whole of the generation of energy, and receive the revenue therefrom.

It will be clear from the foregoing that what we have said with regard to the Electricity (Supply) Bill now before Parliament is correct—namely, that the passage of that Bill is absolutely essential to the operations of the proposed Joint Electricity Authority, and that if the Bill be lost, the work of the Inquiry will be completely stultified. Without the financial clauses the Authority is helpless. The matter is of extreme urgency, for until a definite policy of development is formulated progress will be gravely hindered.

The London County Council recently pressed the Government to say definitely whether it proposed to proceed with the Bill or not. The Special Committee on London Electricity Supply reported that the Committee had already incurred considerable expense in preparing schemes, and thought that "unless it is made clear at an early date that there is a reasonable prospect of the additional powers being obtained that are needed for the establishment of a Joint Electricity Authority on an effective footing, we feel that the Council will require to consider very carefully to what extent it will be justified in taking further action and incurring heavy expenditure in connection with the prosecution of its scheme." This point is of interest not only to the London County Council, but to all other interests in London concerned in the Inquiry; further, it is of interest to the proposed Inquiries in other parts of the kingdom. The Government ought certainly to say definitely whether it intends to proceed with the Bill or not. Its silence on this point, and the constant postponement, might mean anything, and certainly have created an atmosphere of great uncertainty. It is obviously unfair of the Government to allow councils, companies, and others to incur heavy expense at the Inquiries if they are to be afterwards rendered inoperative by the withdrawal of the Bill.

One statement made by Mr. J. H. Rider very emphatically in the course of his evidence was very significant as bearing upon the question of the electrification of railways and the desire of the great railway companies to install their own generating plant—namely, that the Joint Electricity Authority can never hope to supply electricity to the railways so cheaply as they can generate it themselves. The reason is that which we have mentioned previously in connection with the comparative possibilities of private and public undertakings—that the latter must provide a sinking fund to repay the borrowed capital invested in the plant. Hence, the railway companies offer not only to generate for themselves, but even to supply energy to the Authority! As the purpose of the Electricity Act of 1919 is to provide a "cheap and abundant" supply of electricity, this is a consideration which cannot be lightly set aside; if the railways can supply it more cheaply than the Authority, the latter will have no right to refuse the offer. But the matter goes further than that. As indicated above, it raises the whole question of private *versus* public generation of electricity; if a cheaper supply can be given by private enterprise, there is no excuse for imposing upon the consumer permanently increased charges merely for the sake of pandering to the municipal ownership idea. As in North Wales and the West Riding, here again in London the evidence appears to support the view that we have put forward—that the true function of the Joint Authorities should be to supervise the supply of electricity and advise the Electricity Commissioners, leaving the main supply to the hands of private enterprise, which is best qualified to deal with it, and the distribution to the existing undertakers.

Effective Co-operation.

For the past quarter of a century we have from time to time urged British electrical manufacturers to combine their forces—not necessarily their businesses—in order to secure many advantages to which they are entitled, but which they could not hope to obtain single-handed. By joint action they could achieve the reform of specifications for contracts which in earlier days sought to impose the idiosyncracies of consulting engineers upon manufacturers down to the last item in the construction of machines—a practice which inevitably tended to increase the cost to the purchaser without ensuring the slightest gain in efficiency or reliability, and was the very negation of standardisation; they could abolish unfair conditions of contract such as those which compelled British manufacturers to work under conditions from which their foreign competitors were free; they could avoid the reckless price-cutting which resulted from unrestricted internal competition, and which led to corresponding cuts in quality in order to attain the absurdly low cost of production implied by the "lowest tender"; they could secure sufficient profits to permit of a fair amount of research, and so on. All these points have been put forward in our pages, for more years than we care to look back upon, but with little success, for individualism is one of the most deeply rooted characteristics of our race, and only in comparatively recent years has it been realised that co-operation is a fundamental necessity of modern manufacturing conditions. Even now there is a vast amount of scope for the development of the principle of mutual assistance and support, but undoubtedly great progress has been made, and the establishment of such great societies as the Federation of British Industries, the British Electrical and Allied Manufacturers' Association, the Electrical Contractors' Association, and similar bodies has been amply justified by the beneficial results which they have obtained.

The objection which is usually advanced against such combinations is that they put up prices unfairly and enable their members to reap exorbitant profits, and there are certain sections of the lay Press which invariably describe them as "trusts," and appear to imagine that thereby they stigmatise these organisations as inimical to the public welfare and worthy to be damned. Even "trusts," however, are not necessarily harmful, and as a matter of fact, the use of this term is usually wholly unjustified—at any rate, in the case of trade associations such as we have in mind. A "trust," in order to become a profiteering body, must first secure a monopoly of the branch of industry concerned, and for this purpose it must not only embrace within its membership all the British manufacturing firms, but also must be protected from foreign competition—conditions which in this country are impossible of attainment. If, then, a trade association neither desires nor is able to eliminate competition and set up an unhealthy standard of profits, this objection falls to the ground, and no other valid criticism remains to be considered.

Our point is admirably illustrated by the report of a sub-committee on the electrical cable industry, of which an abstract appears elsewhere in this issue. It relates almost wholly to the operations of the Cable Makers' Association, which was formed as long ago as 1899, and for a long time remained the only organisation of the kind which had been successfully established in the electrical industry. A perusal of the report will show that all the objects outlined above have been attained by this excellent association, which has achieved a high reputation not only for the cables manufactured by the constituent firms, but also for the sagacity and integrity with which its affairs have been conducted. That ample competition exists to prevent profiteering is made clear by the evidence, but the most significant conclusions of the sub-committee are those which state that there is a "marked absence of hostility towards the association," and that its operations have so raised the standard of quality of "association" cables that purchasers are willing to pay a higher price for them than for other brands; the cable-making industry is prosperous, and British cables have a world-wide reputation for reliability and durability. No higher testimony to the virtues of combination under wise administration could possibly be desired, and we congratulate the Association on its distinguished record of public service and private advantage which has been further endorsed by the election of its most capable and universally esteemed director, Mr. Ll. B. Atkinson, to the office of President of the Institution of Electrical Engineers.

The Question of Workers' Representation.

The question of the representation of labour on Joint Electricity Authorities came up at the Greater London hearing last week. The London County Council administrative scheme includes in the constitution of the Authority provision for two representatives of workers in the industry. It is further specified that these representatives shall be chosen by certain trade unions to be nominated. It seems, however, an open question whether labour can be legitimately included, since the actual Act of 1919 certainly does not specify labour amongst those who should be included in the Authority. The only reference in the Act under which it could come is "other interests."

It will be remembered that labour was specifically included in the constitution of District Boards in the original Bill (which was afterwards discarded), but to include representation of labour in an entirely voluntary body, such as the Joint Electricity Authorities are supposed to be, is another question altogether. Further, the question of including representatives of trade unions on the London Joint Authority has also a special aspect in view of the circumstances in London. It will be remembered that the position of the trade unions in London is that they have given instructions to their members to refuse to connect up installations which have been erected by non-union labour. They have also taken action, similar in effect, with regard to kinema shows where union rules are not observed. The unions interested in the electricity supply industry thus claim the right to use the industry as a lever to enforce their claims in quarters which have nothing whatever to do with the electricity supply industry itself. We are not discussing at the moment the legitimacy or otherwise of such claim, but simply stating the fact as having a bearing upon the inclusion of representatives of these unions on a Joint Electricity Authority. The Joint Electricity Authority when formed will become the Authority which will regulate the development of supply throughout Greater London, and thus be in a position of extensive power and responsibility, its first duty being to maintain uninterrupted supply. Conceivably cases would crop up where the trade unions decided to take drastic action in one direction or another, and it would surely be an anomaly if on the one hand the Joint Electricity Authority were striving to maintain supply, and on the other hand the workers were receiving instructions from one of the trade union members of the Joint Authority to take steps towards stopping the supply.

Whether the appeal case at Hackney will do anything towards settling this awkward situation is still to be seen, but so long as the trade unions claim the right to use the electricity supply industry to settle outside quarrels it would surely be indiscreet to give their representatives a seat on the Joint Authority controlling the supply of London. The principle to which these trade unions have thus committed themselves is a very big one, and may conceivably become, sooner or later, of very serious importance. We quite sympathise with the London County Council in its general wish to secure the interests of the workers in the way mentioned, and we should raise no criticism if it were representation of the workers simply as such, but it is not. It is a question of taking into the Authority representatives of unions which, as we have pointed out, have interest in militant action far beyond the scope of the Joint Electricity Authority.

D

ELECTRIC VEHICLE PROGRESS AT BIRMINGHAM.

A New Battery-charging Station.

The City Corporation of Birmingham, it is believed, has one of the finest fleets of electric vehicles in the country, and in the collection and removal of house refuse great economies have been effected by the utilisation of electric vehicles in place of horse-drawn wagons.

The use of a large fleet of such vehicles naturally involves the provision of extensive battery-charging facilities, and the following particulars and illustrations of a plant to provide energy for that purpose, which has been installed by Mr. S. Thomas Pemberton, M.I.E.E., for the Birmingham Corporation Salvage Department, will be of interest.

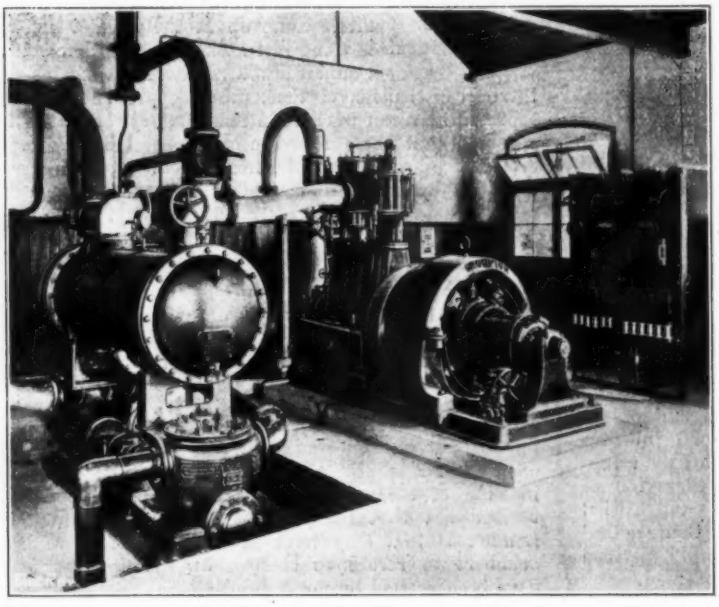

Fig. 1.—Belliss-Crompton 75-kW Generating Set.

Prior to the erection of the plant, the steam generated by the burning of refuse at the Corporation Destructor Works at Lifford, King's Norton, was discharged to atmosphere; it is now, however, utilised to generate electricity which is used to charge the vehicle batteries and also to drive motors in connection with the water-softening, tin-bundling, and clinker-screening plant. The saving to the department is enormous, as it will be realised that the electrical energy is produced as what might be termed a by-product from the heat derived from burnt refuse.

An interior view of the power house is shown in fig. 1, which, it will be seen, contains a Belliss & Morcom vertical steam engine direct coupled to a Crompton generator. The exhaust steam is discharged into a surface condenser supplied by Messrs. J. Evans & Son, Ltd., the water for which is obtained from the canal near by. The output of the generating plant is 75 kW.

The interior of one of the garages is illustrated in fig. 2; the equipment in these buildings consists of watt-hour meters and specially constructed cast-iron connection boxes for the purpose of attaching the flexible charging cable to each vehicle, this method being preferable to the use of plugs and sockets, owing, it is claimed, to its being possible to secure a more solid and positive contact therewith.

The third figure shows the vehicle-charging switchboard of the well-known Igranic type, which has already been described in our pages. It is suitable for charging 10 vehicles at once, and two blanks have been left for future extensions. With regard to the remainder of the installation, all the underground cable was supplied by Callender's Cable and Construction Co., Ltd., the wiring was carried out by the Stuart Electric Co., and the power panels and motors were furnished by Messrs. Electromotors, Ltd.

The plant as a whole is sound and comprehensive, and the scheme reflects credit on Mr. James Jackson, superintendent of the Salvage Department, who introduced the idea, and his departmental engineers, Messrs. Codlin and Sainsbury, not forgetting Mr. Pemberton, under whose direction the scheme was carried out. It is interesting to note that the Salvage Committee is so satisfied with the whole lay-out of the job that it proposes to duplicate the plant at another of its destructor works at an early date.

The Salvage Department now has in commission a fleet of 31 Edison 2½-ton vehicles, and one Orwell 3½-tonner, and a report was recently issued dealing with the service of the electric vehicles for the second six months of last year, when 26 Edisons and the one Orwell lorry were operated. Attention is called to the saving which has been effected in the Montague Street area by substituting electric vehicles for horse-drawn wagons in the outlying portions of the area, and by confining the horse traction to the area nearest to the depôt, namely, within a radius of about 1¼ miles.

Statistical information has been prepared relating to the combined system of working electric vehicles and horse-drawn wagons in the Montague Street area, which is summarised as follows:—

Item.	Electric vehicles.	Horse wagons.
Number of rounds (one transport unit for each)	6	10
Average interval between each visit (working days)	6·19	6·46
Average number of houses visited per week:		
By one vehicle and four men	2,116	—
By one horse wagon and two men... ...	—	846
By a two-horse wagon and four men to compare with electric-vehicle labour ...	—	1,692

From this table it is clear that each electric vehicle working in the outer portion of the Montague Street area, and travelling double the mileage of the horse wagons per day, visits as many houses as approximately 2½ horse wagons visit in their restricted area near the depôt. The cost per house visit is as follows:—

	Per hour per week.
Horse wagons—continuous system—inner area ...	3·22d.
Electric vehicles ,, ,, outer ,, ...	2·94d.
Saving in favour of the electric vehicle per house per week	0·28d.

This represents a saving of £125 per annum for each electric vehicle, but the figure is really greater than this, because if horses had to travel to the areas now served by electric vehicles they would not visit nearly as many houses as they do in the inner area. It is estimated that the saving effected by transferring two horses from long-distance work into the inner areas, or short-distance work, effects a further saving of at least £125 per annum, so that each electric vehicle, directly and indirectly, results in a reduction of the working costs by no less a sum than £250 per year.

The view is expressed that there are distinct spheres of operation for both the horse-drawn and the electric vehicles, and that a reduction in costs can best be obtained by utilising both methods of transport. For the electric vehicle to compete with horse haulage in the inner area, which comprises mainly a poor class of property, from which there is nearly 40 per cent. more refuse (in weight), it is stated that it would be necessary to have a 3½-ton vehicle with a body

capacity of 9 cb. yards. Doubts are expressed about whether it will ever be practicable for electric vehicles to collect more than three full loads per normal working day, because the extra loads would involve additional

has been pointed out to the city electrical engineer that as most of the electrical energy used for charging the electric vehicles is taken from the generating stations at night time, during the "off-peak load" period, a reduction in the price

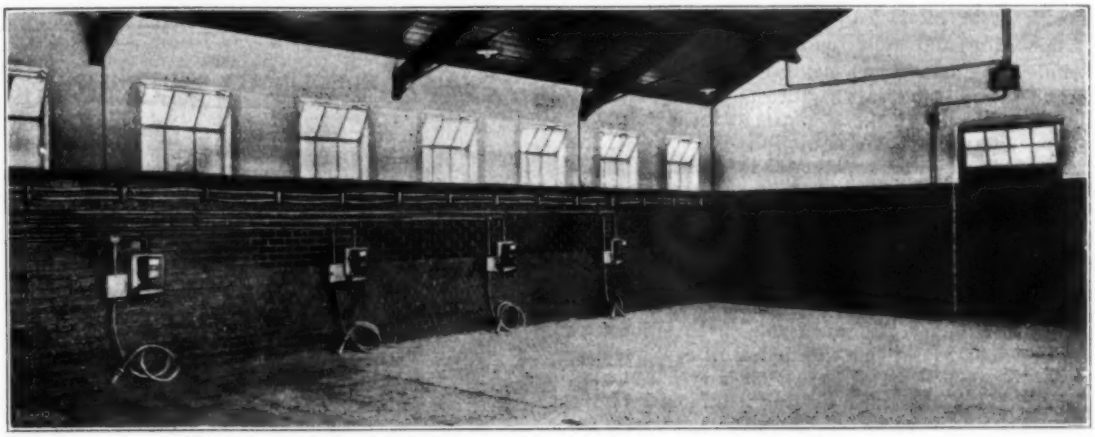

Fig. 2.—Electric Vehicle Charging Garage at Birmingham.

travelling time and, therefore, reduce the loading time now available.

A comparison is made of the working costs of the vehicles operated. These are summarised as follows:—

	Per day worked.	Per ton carried.
26 2½-ton "Edison" vehicles ...	£4 4s. 5·7d.	14/0·81d.
1 3½ „ "Orwell" vehicle ...	£4 6s. 7·2d.	13/8·17d.

Interest and repayments were calculated on the basis of a seven-years' life, except in the case of the battery of the "Orwell" vehicle, which was depreciated on the basis of a two-years' life.

During the six months under review the "Orwell" vehicle was employed in a district wherein the refuse was of a heavy nature, and the average weight collected per load was two tons, four cwt., three quarters, as against two tons, two cwt., three quarters collected by the "Edison" vehicles, thus making use of the additional strength of the "Orwell" chassis. This accounts for its cost per ton being lower, while its cost per day was higher than that of the "Edison" vehicle.

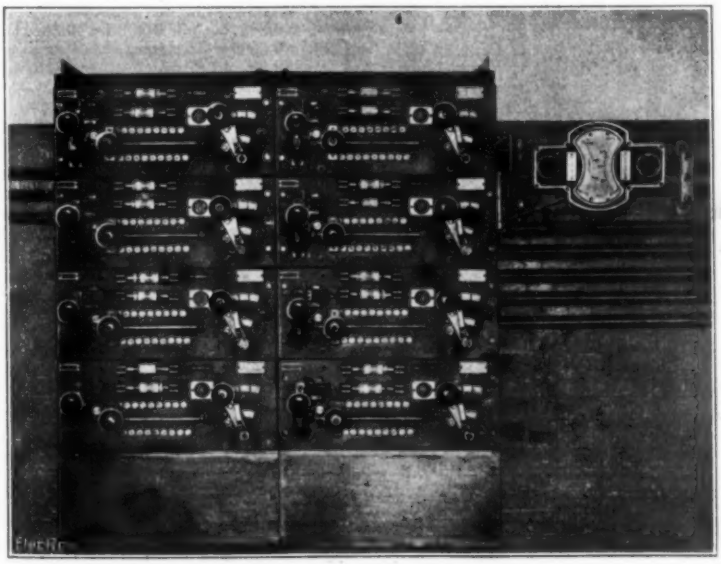

Fig. 3.—Igranic Battery-Charging Switchboard.

The cost for electrical energy for charging the vehicles was as follows:—Edison, 1/0·28d. per ton; Orwell, 11·05d. per ton. These costs are based on a price of 2⅜d. per kWh. It

per kWh should be made. The suggestion is being favourably considered, and a reduction of from 30 to 40 per cent. is anticipated.

The following table shows the continuity of work and the percentage of working days lost by both makes of vehicle during the 12 months of last year:—

	One Orwell vehicle.			Edison vehicles.		
Quarter.	Days worked.	Possible working days off work.	%	Days worked	Possible working days off work.	%.
March ...	74	3	3·90	255	28	9·82
June ...	70	—	0·00	751	141·5	15·85
September	77	—	0·00	1,178·5	102·5	8·00
December	76	1	1·30	1,466	194	11·69
Totals...	297	4	1·33	3,650·5	466	11·07

The batteries of both makes of vehicle gave practically no trouble. The time lost by the Edison vehicles was mainly due to temporary difficulties in the supply of certain parts, but Messrs. Edisons have readily and willingly taken such steps as will, it is thought, avoid further trouble.

Since January 1st five new Edison vehicles have been received, and during the coming financial year a generating set is to be installed at the Bolton Park Street depôt, and provision has also been made in the estimates (which have been approved) for one 3½-ton electric vehicle, for which it is hoped a suitably large body can be obtained, which will enable experiments to be made in comparison, not only with the existing vehicles, but also in the inner areas in competition with horse haulage.

"The great results achieved in installing one of the best collection systems in this country, which in many of the districts would not have been practicable with horse haulage, combined with a considerable reduction in working costs, will, I hope and trust," states the superintendent of the Corporation Salvage Department, "permit of a great increase in the use of the 'electrics' when the financial position of the Corporation becomes easier."

TRADE UNIONS AND PROFIT-SHARING AGREEMENTS.

(By a Legal Contributor.)

A case recently decided in the Court of Appeal will be read with great interest by those who are interested in profit-sharing and co-partnership as means of bringing employer and workman together. The trade union objects to these schemes. They are apparently suspect because they tend to make a workman independent of his union, and unamenable to discipline. The question whether, in the existing state of the law, a trade union can prevent one of its members from entering into any such arrangement was considered in Braithwaite *v.* The Amalgamated Society of Carpenters, which is reported in *The Times* of June 14th.

The facts are simple enough. The plaintiff sought an injunction to restrain the defendants from expelling him from their ranks. It was a rule of the union that a member might be fined or expelled if he is "working on a co-partnership system when such system makes provision for the operator's holding a minority of the shares in the concern." The plaintiff had, in fact, become a member of Lever Bros, Ltd., Co-partnership Trust, and because he did so, an attempt was made to expel him on the ground that he had committed a breach of the rule above mentioned. It was contended that no action lay because of Section 4 of the Trade Union Act, 1871, which provides that nothing in the Act is to enable any Court to entertain proceedings instituted with a view to directly enforcing or recovering damages for the breach of an agreement.

In the Court below Mr. Justice Eve had held that on the authority of Chamberlain's Wharf *v.* Smith (1902) 1 Ch. 605, the action could not be maintained, but the Court of Appeal thought otherwise. The Master of the Rolls said: "The plaintiffs do not dispute the validity of the rule; they say they have not done anything to contravene it. It must be an attempt to enforce an agreement by which the defendants agreed to do something. Where is that agreement to be found? In my opinion no such agreement can be found in the rule at all. The only agreement which it implies was the one arising from membership. There must be implied on the part of the member an agreement to comply with the rules, and on the part of the defendant union an agreement to give the member certain benefits so long as he complied with the rules. It seems to me that the answer to the question, apart from authority, is that the defendants *never made any agreement*, but had made it a condition of membership that the plaintiffs should not commit any breach of the rules."

The Master of the Rolls then examined Lord Leverhulme's co-partnership scheme, pointing out that it did not oblige any workman to take shares in the concern, nor was there any provision that the workman should always hold a minority of the shares. In another case, tried at the same time, it was held that one Ashley, a member of the General Union of Operative Carpenters and Joiners could not be expelled from that body because he had joined Lord Leverhulme's premium bonus system.

Lord Justice Younger, in giving judgment, drew attention to the importance of these cases. "For a man to be expelled from his trade union means that he can obtain practically no employment in his own trade. He is in danger of becoming what Lord Justice Fletcher Moulton in another class of case once described as an odd lot in the labour market. Expulsion from the union is a sentence of industrial death."

The moral of this case is that the Court will in effect prevent the expulsion of a member from a union unless it is clearly shown that he has contravened a rule. It will not do for the union official to merely say: "You must not join your employer's co-partnership or profit-sharing scheme or I will have you expelled." He must go further, and be in a position to say that to join that particular scheme was to infringe a particular rule by which the workman was bound.

We imagine that it is not by any means beyond the capacity of employers like Lord Leverhulme so to frame the rules of a co-partnership scheme as to avoid clashing with the rules of any union to which their workmen belong.

JOINT ELECTRICITY AUTHORITIES.

(*Continued from page 799.*)

London and Home Counties Inquiry.

On Wednesday, June 15th, Mr. J. H. Rider, who, with Sir Alexander Kennedy, Mr. G. W. Partridge, and Mr. C. H. Wordingham, has prepared the technical scheme embodied in the London County Council's proposals, explained the modifications which had been made in the scheme as originally presented to the Commissioners, and the reasons for them. The Committee of Engineers was formed in May, 1920, Sir A. B. W. Kennedy and Mr. G. W. Partridge being appointed by nine of the companies, Mr. Rider by the L.C.C., and Mr. Wordingham by the Conference of Local Authorities owning electricity works in Greater London. As stated by Mr. Craig Henderson on the opening day, Sir Philip Dawson, on behalf of the railway companies, had approved of the technical scheme. Under the original scheme, the construction of the capital stations already referred to, viz., three on the river Thames east of the Blackwall Tunnel and one in the west at Chiswick, together with the extension of two of the existing stations, was to be taken in hand at an early stage. The two existing stations which are to be extended are Stepney and Deptford. Although this part of the scheme still holds good, it has been decided, in the light of financial conditions, to postpone the construction of capital stations, and to proceed, as the first stage of the scheme, with the linking-up of a certain number of the existing stations, which have been named group stations, to meet the demand until 1925-6, and then to add additional plant in nine or ten of the existing stations to deal with the load for a further period, unless the conditions permit of the construction of the capital stations. The following table gives the group stations which are to be linked up, showing the new plant which is to be added, and the amount of plant it is proposed to scrap, and this linking-up forms the nucleus of the modified proposals as now placed before the Commissioners by the London County Council:—

Station.	Existing plant. kW.	New plant. kW.	Scrapped plant. kW.	Total. kW.
West Ham ...	17,900	10,000	3,900	24,000
Poplar	9,750	6,750	—	16,500
Stepney	16,000	10,000	—	26,000
Shoreditch ...	8,800	5,000	3,800	10,000
Hackney	18,200	9,000	1,200	26,000
Walthamstow	5,800	3,300	1,800	7,300
Bow (Charing Cross Co.)	20,400	12,000	6,400	26,000
Bankside (City of London Co.)	30,000	26,000	10,800	45,200
Islington	9,250	5,000	3,250	11,000
St. Pancras (King's Road)	5,500	11,600	—	17,100
St. Marylebone ...	19,000	17,600	2,000	34,600
Grove Road (Central Co.)	20,220	35,000	5,220	50,000
Horseferry Road (Westminster Co.) ...	5,100	3,000	—	8,100
Hammersmith ...	11,400	12,000	2,400	21,000
Wood Lane (Kensington and Notting Hill Co.)	11,900	—	1,600	10,300
Battersea	9,524	5,000	3,024	11,500
Barnes	1,500	3,000	—	4,500
Kingston	3,240	—	700	2,540
Wimbledon	4,825	3,000	1,325	6,500
Willesden (Metropolitan Co.)	23,000	16,000	9,000	30,000
Uxbridge	6,100	2,000	1,700	6,400
Wandsworth (County Co.)	20,500	6,000	—	26,500
South Metropolitan Co.	17,500	—	1,000	16,500
South London Co. ...	7,000	—	3,500	3,500
London Electric Corporation	44,350	3,500	15,350	32,500
Croydon	5,500	10,000	1,000	14,500
Woolwich (Globe Lane)	10,250	10,000	—	20,250
Gravesend	1,800	7,000	800	8,000
Brimsdown (North Met. Power Co.)	12,750	15,000	4,750	23,000
Willesden (North Met. Power Co.)	18,500	—	—	18,500
Totals	395,559	246,750	84,519	557,790

In this way it is calculated that the Joint Authority would have at its disposal by 1925, without having spent any money on capital stations, 557,000 kW to meet an estimated demand of 480,000 kW.

The CHAIRMAN raised the question of reserve plant, and Mr. Rider pointed to the fact that there would be a number of other stations which could be called upon for assistance to the extent of 75,000 kW, although they would not form part of the linked-up group stations. These he named as Barking, Beckenham, Bermondsey, Bexley, Dartford, Ealing, East Ham, Erith, Finchley, Hampstead, Heston and Isleworth, Hornsey, Ilford, Leyton, Southwark, Bromley, Earls Court (Brompton & Kensington Co.), Chelsea, Chiswick, City Road (County Co.), Egham, Harrow, Surbiton, Tottenham, and Twickenham. He added that a number of stations in the central area had not been taken into account because they were practically in process of being shut down by their present owners. Further, it was pointed out quite clearly that under this linking-up scheme, as the first stage of the comprehensive proposal, a number of stations on the fringe of the area would not be assisted in any way, and that these districts must go on as they were now for some time to come. Under present financial conditions it would be too expensive to lay the necessary mains.

Continuing, Mr. Rider said that if in 1925 it was still found impossible to erect the new capital stations, then it would be possible to extend nine or ten of the existing power stations so that the total plant available would be 760,000 kW. By that time, plans would have to be put in hand for the capital stations owing to the urgency of the increasing demands, whilst no doubt the financial position would be much improved. At present, however, the gain in lower working costs to be obtained from the capital stations would be more than off-set by the higher capital charges. When the whole scheme was completed and the capital stations were working, it was provided that the only existing power stations which would be kept in operation would be Willesden (North Metropolitan Electric Power Co.), St. Marylebone, Grove Road (Central Electric Supply Co.), Hackney, Bow (Charing Cross Co.), and Bankside (City Co.). When that would actually happen he could not say.

The question of leaving out of account some of the "fringe" areas for some time to come was taken up by the Commissioners. Mr. BOOTH asked what was the object of keeping them in the area if they were not to be assisted from the beginning. Was it Mr. Rider's opinion that a better scheme could be produced by reducing the area?

Mr. RIDER said the cost of taking the supply to the extreme areas must be much greater than that of supplying the inner area, utilising the existing stations, and from the engineering point of view, it would be a better scheme to omit some of the outside areas. Some assistance might be given to the outside areas, however, through the railway supply, which the figures he had given had not taken into account.

The CHAIRMAN said it was the possibility of getting assistance in the outside areas from the railway supplies that had induced the Commissioners to delimit the area in the way they had.

Mr. RIDER said a great deal depended upon the nature of the railway supply.

Discussing the question of costs under the original scheme and the one now proposed, excluding railway supply, it was pointed out that under the revised scheme, the cost per unit delivered to the feeders by authorised distributors, after conversion, would be 1.385d., whereas under the original scheme it would be 1.488d., whilst under the original scheme with the railways included the cost would be 1.377d., all these figures being averages over the whole area for the first stage. In order to make the linking-up scheme work efficiently, it would be necessary to have the central controlling body or Joint Electricity Authority to control the whole of the undertakings, not only as to giving supply, but as to the hours when certain stations should work, where plant should go in, &c., even down to the book-keeping of the generating side of the business. It was for this reason that the expenditure of the Joint Authority was placed at £50,000 per annum, because there would have to be a technical staff to carry out this work of supervision and management.

The chief cross-examination of Mr. Rider on Wednesday came from the promoters of the East London scheme, although on the admission that the outer areas could not be assisted for some time, counsel for the Hertfordshire County Council and the North Metropolitan Power Co. suggested that as it appeared the area was unwieldy, it would improve the position if they were left out.

The point of the cross-examination on behalf of the East London scheme was that by splitting the area delimited by the Commissioners into several smaller ones, a more efficient service would be obtained, at any rate, for industrial London, cheap power being essential to industry. It was put to Mr. Rider that to have a large area such as was proposed in order to bring down the average cost over the whole was not the right way to proceed, when certain of the districts, and those the most important industrial ones, were already supplying energy at a lower rate than the average estimated under the revised scheme.

Mr. RIDER, however, stuck to the point of view that there must be a large area, and that all the undertakings in it should come into a common pool for the good of the community as a whole.

Sir HERBERT NIELD, K.C., for the Hertfordshire County Council, expressed a fear of territorial aggrandisement on the part of the London County Council, and suggested that that was behind the desire to get such a large representation on the Joint Electricity Authority, which would be dominated by the L.C.C.

Mr. SYDNEY MORSE, for the West Kent Electric Power Co., referred to the scheme for the erection of a new power station by that company upon which the Commissioners had deferred their decision. He said the company would want 60,000 kW in a comparatively short time; where was it to come from, under the L.C.C. scheme?

Mr. RIDER said that if such a demand were made upon the Joint Electricity Authority steps would be taken to meet it.

On Thursday, June 16th, Mr. WROTTESLEY, for the Middlesex County Council, endeavoured to get an expression of opinion from Mr. Rider as to parts of the area being cut out, but Mr. Rider was emphatic that some substantial portion of Middlesex must be included. He would not agree to making the boundary of the electricity supply area on the north and west that of the County of London.

The CHAIRMAN asked Mr. Morse, on behalf of the West Kent Co. and the County of London Co., to give details, some time during the inquiry, of the developments involving 60,000 kW in the case of West Kent, and of the anticipated developments in the County of London Co.'s area. Although evidence was given at some length with regard to the latter during the inquiry in October (ELECTRICAL REVIEW, October 15th and 22nd, 1920) concerning the Barking station, it was not quite sufficiently detailed for the purpose of the present inquiry.

Mr. MORSE promised to do this. Continuing his cross-examination of Mr. Rider, he elicited the fact that the site of one of the proposed capital stations the same as that of the old Thames Ironworks, and that it was the same site as that proposed in the scheme which was being placed before the Commissioners by the Great Eastern Railway Co. The available land there was 13 acres; at Chiswick there were 25 acres, and the other two stations at Beckton and Greenwich would be on sites of 16 and 9 acres respectively. The point of Mr. Morse's questions was to compare the proposed new stations with the County of London Co.'s proposed station at Barking, and to that end he went through the relative advantages as regards the usual facilities.

Mr. RIDER was reminded that during the October inquiry into the County of London Co.'s application to the Commissioners *re* Barking, he said that new generating plant was required immediately at that time, and that there was need for a new large station as soon as it could be built.

Mr. RIDER said he was still of the same opinion if financial conditions permitted, and it was only because after having spent a lot of money the cost per kWh was no cheaper, that he now suggested that the capital stations should not be built at once.

Further questions showed that the total sales of energy in 1925-6, exclusive of railways, would be 960 million units in the whole area, compared with 608 millions, an increase of 352 millions, or 58 per cent. in the six years, equal to 7.8 per cent. annually. Mr. Morse suggested that on the figures of the County of London for 1918-19 and 1919-20, and applying these to the whole area, there would be an increase of 230 per cent. during the coming six years. Similarly it was pointed out that on the basis of the County of London Co.'s own increase in 1918-19 and 1919-20 the increase carried forward six years would amount to 215 per cent., again a very much larger increase than had been allowed for over the whole area by Mr. Rider.

Asked how he proposed to deal with the increasing demand of the County of London Co. up to 1925, Mr. Rider said he would deal with it from City Road, Wandsworth, and Bankside, and if the load should grow beyond the capacity of the available plant in these stations, or if there should be a breakdown, there would be help available from other stations linked up. If the general growth was more rapid than anticipated in the scheme now put forward, it would mean that the second stage would come into operation more quickly.

The CHAIRMAN said the Commissioners would require assistance on this matter, because it took a long time to get plant installed, and it would be necessary to put forward a proper scheme dealing with the contingency of a more rapid development than had been assumed, as indicated by the figures put in by the County of London Co. At present there would be available 39,200 kW in the County of London Co.'s stations and 10,000 kW ear-marked at Bankside under an agreement to deal with the County Co.'s load. Supposing that the company's demand increased, as suggested, to a figure for which this plant would not be sufficient, how could it be met?

Mr. RIDER said that if the County of London Co. or any other undertaker required more plant, some notice would be given to the Joint Authority, and arrangements would have to be made either for the erection of a capital station or for additional plant to be installed in some of the existing stations, which could be done to the extent of another 190,000 kW.

The CHAIRMAN pointed out that the County Co. expected a load of from 40,000 kW to 51,000 kW according to the load factor, in 1924-5.

Mr. RIDER said that the curve he had prepared of the estimated increase over the whole area was on a basis which was higher than that which had yet taken place, except during the war period.

The question of the estimates of increase in individual cases was raised, and the chairman said it was most important

for the Commissioners to have the estimates from the L.C.C. in each case for comparison with what the individual companies, such as the County Co., said would be the position four or five years hence.

Mr. RIDER said his estimate of the County Co.'s load in 1924-5 was 36,700 kW, against the company's figure of 40,000 kW.

The CHAIRMAN said that 40,000 kW was on the basis that the company did not make special efforts to increase the demand between now and 1924-5, as it saw no prospect of meeting it without the new Barking station.

Mr. RIDER said he had also estimated 20,000 kW for the Romford area of the County Co. by 1931, and the company could have 10,000 kW as soon as the Joint Electricity Authority got to work. That 10,000 kW would be supplied from Stepney, Poplar, West Ham, and East Ham, the linking-up of which would cost £100,000, although the mains would not be laid only for the supply of the 10,000 kW in question. The total cost of the mains for linking-up throughout the whole area was £1,000,000.

Mr. MORSE suggested that to have to get the 10,000 kW from four stations was a little complicated.

Mr. RIDER agreed, but added that it was quite practicable, and the 10,000 kW would be available within a period of two years, assuming the Joint Electricity Authority got to work at once.

Answering questions with regard to the position of Croydon, Mr. Rider said that it did not form part of the preliminary linking-up scheme, and would only come in ultimately as part of the whole scheme. Nevertheless, the Croydon station would be under the control of the Joint Electricity Authority, and he anticipated that Croydon would be supplied with energy at no higher price than at present. Croydon would receive no benefit until the capital stations were built. Nor would Croydon be any worse off, but meantime it would be under control as part of the general scheme. The same applied to Kingston, Guildford, and some other towns similarly situated on the fringe.

Questions were next put on behalf of the Metropolitan Electric Supply Co., the objection already lodged with the Commissioners being to that company's bulk supply area in Middlesex being included in the scheme, but the company did not object to the area now served by it in the County of London being included.

Mr. RIDER said he could not agree to leave out the Metropolitan Co.'s area, because it was within the limits of economical distribution from the Chiswick power station, when that was built.

Mr. G. SPENCER HAWES, representing Guildford Corporation, asked for exclusion from financial liability under the scheme, seeing that Guildford would not benefit in any way for a long time.

Mr. RIDER's answer was that that was an administrative matter, and must be determined by the Joint Authority. On the question of the cost of energy obtained from the Authority, an authorised distributor could not be asked to pay more than he could generate at for himself. There would, however, be varying tariffs for the energy supplied by the Authority.

Sir HARRY HAWARD asked why there should not be a uniform scale of charge for energy by the Authority based on load factor.

Mr. RIDER said it could be done, but it would not be altogether fair, because distance must come into consideration, although primarily the scale would take into account the load factor.

Mr. CRAIG HENDERSON, K.C., re-examining Mr. Rider, dealt with the application of various authorities and companies to be left out of the area. Mr. Rider said the Joint Electricity Authority could only supply in bulk to authorised distributors and power companies, and could not compete in any way with an existing authority unless the latter failed in its statutory duties. The whole object of the Joint Authority was to assist and not to compete. As to the County of London Co., it was giving supplies to authorities outside its area, which were putting a strain on the supply within the company's own area, and, moreover, it might be that the Joint Authority would be able to give these outside supplies from more convenient sources.

Discussing the Barking station and Mr. Rider's objection to putting 600,000 kW there, the CHAIRMAN asked if Mr. Rider would have the same objection if Barking were restricted to 200,000 kW, or the same size as the proposed Beckton power station of the L.C.C.

Mr. RIDER said the position then would be that the cost of transmission from Barking would be a little higher, whilst Beckton would also have an advantage as regarded fuel, because by-products from the coal distillation plant of the Gas Light & Coke Co. would be used.

At the conclusion of his re-examination, Mr. Rider was questioned by Sir HARRY HAWARD as to the reason for his change of opinion as to the need for capital stations, since he gave his evidence on the County Co.'s proposal in October. Surely the financial conditions were no worse now than they were in October, and in fact they were inclined to improve.

Mr. RIDER said his change of opinion was not caused by the alteration in prices, but by a more intimate knowledge of the circumstances of the case. Had he known in October what he knew now as to the advantages to be gained by linking-up, he would not then have said that a capital station should be erected as soon as possible. It was not so much a question of alteration of conditions, as an alteration in the knowledge of himself and his colleagues.

Sir HARRY HAWARD pointed out that the County Co. was willing to proceed with the erection of a capital station now, notwithstanding the financial conditions.

Answering questions by Sir Harry Haward, Mr. RIDER said that the only capital expenditure in which the Joint Authority would be involved before the capital stations were built, would be £1,050,000 for mains and plant replacement.

Subsequently Sir HARRY HAWARD said it must be made perfectly clear what was to be the position of the Joint Electricity Authority as a separate entity in relation to the existing stations. It was not at all clear to him as the case had been presented so far.

Mr. RIDER said a subsequent witness would deal with this point. He himself was not prepared to speak as to the conditions upon which power stations should be taken over by the Joint Authority, but it would have to be a matter of arrangement whether the staffs of the generating stations were paid by the Joint Authority or the authorised distributor.

Sir HARRY HAWARD also put a series of questions as to the revenue of the Joint Authority, because although there was to be an expenditure of £1,050,000 during the first five years, there was no estimate of revenue. So far as he could see, the Joint Authority would be a clearing house.

Mr. RIDER replied that as it was the idea that the Joint Authority would take over the whole of the generation side, it followed that it would handle the whole of the revenue from generation.

Mr. PAGE said it seemed that the Joint Authority was to have all the privileges of ownership without the responsibility.

Discussing the railway supply, Mr. Page said he regretted to see the L.C.C. taking up a timid attitude with regard to this. He elicited from Mr. Rider that, owing to the fact that the Joint Authority, when it came to erect a capital station, would have to put aside a sinking fund, it could never offer the railway companies such a cheap supply as the railway companies could generate for themselves. In fact, the railway companies had intimated to the L.C.C. and the Commissioners that they would prefer to put up their own generating stations and supply the Joint Authority itself.

Mr. PAGE: And you will lose that complete control of the whole of the generation by the Joint Authority which you have said was so desirable to the success of the scheme?

Mr. RIDER admitted that that was so, and added that so long as the Joint Authority had to provide a sinking fund for a comparatively short period, it could never offer the railway companies sufficiently good terms at any time.

Mr. PAGE, on Friday, June 17th, in continuing his questions as regards railway supply, said that Mr. Rider's evidence on the point had struck at the root of the scheme, and he wished to carry the matter further. He asked whether it was possible to suggest a scheme by which the financial position of the Joint Authority with regard to sinking fund could be improved so that the railway companies could be supplied by the Joint Authority?

Mr. RIDER promised to bring forward a scheme. He had not gone into the details of what the railway companies estimated they could do, and his view already given was based on those estimates. The railway load which the Joint Authority might get was estimated at 200,000 kW for the L.B. and S.C. Railway, the South-Eastern Railway, the Great Eastern Railway Co., and the Midland Co. The Great Western, South-Western, and North-Western railways had their own generating stations, and it seemed that the railway companies might erect a number of comparatively small stations, which would not be desirable. The point was that the Commissioners could not refuse permission to railway companies to build stations if they could show that they could generate at a lower price than the Joint Authority could offer.

Passing on to distribution, Mr. Page received the emphatic opinion that the existing distributors were the best people to carry on this work, and not the Joint Authority, provided, of course, that the technical staff of the two bodies were kept separate. Generally speaking, the Joint Authority should have nothing to do with distribution, said Mr. Rider.

Questions were then put as to the position if the load developed more quickly than anticipated and necessitated the building of capital stations earlier than contemplated. Would not the last stage be worse than the first, said Mr. Page, because a large sum of money would have been spent on smaller and less efficient plant in the existing stations?

Mr. RIDER did not think there would be much loss of efficiency. Moreover, the installation of this plant would take some time, and the Joint Authority would be able to determine in advance whether it was best to extend the existing stations or build a capital station. Sufficient money had been provided in the expenses of administration of the Joint Authority to provide for a technical staff of sufficient calibre to be able to determine what was the best thing to do at the psychological moment.

Mr. LACKIE referred to the opinion of Mr. Rider that more than 10,000 kW could not be transmitted by a single cable, and suggested that that figure was too low.

Mr. RIDER said it was based on 33,000 volts, 0.25 sq. in., three core, 220 amps. per phase on a 0.8 power factor. He had not considered 66,000 volts in this connection, but had preferred to keep to what was considered good practice to-day.

A cable could not be run at that pressure with safety, at a higher temperature rise than 60 deg. F.

Mr. LACKIE said a figure he had was 65 deg. F. temperature rise, 310 amps. per phase, which was about 14,000 kW per cable.

Mr. RIDER said some people did run their cables at a higher density, but he preferred not to.

Mr. LACKIE contrasted the figures with regard to railway supply, so far as this was taken into account, and asked if Mr. Rider had been in consultation with the railway companies to ascertain what they would be prepared to pay.

Mr. RIDER said he had not, but without capital charges he could supply as cheaply as the railway companies could generate. The railway load would improve the load factor of the capital station.

Mr. LACKIE suggested that the railway companies and large industrial users might be prepared to pay a somewhat higher price if they were assured of reliability through the capital stations rather than a linking-up policy.

Answering the chairman, Mr. RIDER said that £100,000 had been allowed for each of the new sites, that being only for the land and clearing. With regard to railways, he acknowledged that the railway load improved the general supply, and although he agreed with Sir John that it was not wise that the railway companies should be encouraged or even allowed to build their own stations, by the terms of the Act of 1919 the Commissioners were bound to give consent to any other power station unless they could show that an equally cheap and abundant supply could be obtained elsewhere. It all depended on price, however, and he believed the railway companies were sufficiently good business undertakings to take a supply from the Joint Authority if an advantage could be shown.

Sir JOHN SNELL followed this up by a reference to sinking fund, which Mr. Rider had previously spoken of as turning the scale against the Joint Authority, and pointed out that the average of the sinking fund was 2½ per cent. on an equated period of 25 years. At present, local authorities could borrow money at 6½ per cent., and they might soon be able to borrow at 6 per cent. He then assumed that railway companies could not borrow at less than 7½ per cent., which should go far towards balancing the difference between the costs of generating by the Joint Authority and a railway company.

Mr. RIDER agreed, but added that the railway companies were not bound by statute to set aside anything for depreciation. For instance, they would not depreciate land, whereas the Joint Authority had to pay off the loan in 60 years. Again, there were turbines and boilers which had been in efficient use for longer periods than those allowed for the repayment of the loan. Further, the railway companies could set money aside for depreciation when their finances allowed instead of being compelled to set aside a definite amount every year. As an engineer, he would say that the supply should be given by the party which could give the cheapest and most regular supply, irrespective of whether it was a private company or a public authority. In the case of the Great Eastern Railway Co., he admitted that on the site proposed by that company, which belonged to it, generation could be carried on there for the purposes of the railway company more cheaply than the Joint Authority could give a supply, because the site was at the very point where the load was.

In order to bring the scheme into proper sequence, Sir John put it that there would be 557,000 kW in the existing stations, which would be developed to a total of 756,000 kW, after which steps would be taken to erect capital stations and the existing stations gradually shut down.

Mr. RIDER agreed, and said that 225,000 kW of the old plant in the existing stations would gradually be scrapped as the capital stations were developed.

Questions were then asked by Sir John as to how it was proposed to meet the anticipated demand of 60,000 kW in the West Kent area.

Mr. RIDER said he did not agree with that estimate of the requirements in the near future. The development in this district during the first stage, however, would be met from the existing stations at Blackwall Point and Woolwich, and future provision must depend upon the circumstances. He reiterated that he assumed the Joint Authority would have a technical staff of sufficient ability to meet the situation from time to time.

The CHAIRMAN concluded his questions by saying that, broadly, he took it that the position was that owing to the high costs of capital and plant, Mr. Rider felt it was incumbent to make the most of the existing plant, by making certain additions and linking up to a certain extent. That was the first stage. Then if the rate of growth in any particular locality was quicker than was anticipated in the estimates, there was the flexibility of two alternatives, either to gradually increase interconnection between other stations in support of those already interconnected, or supplement them by adding further plant in certain selected stations, or if it was more economical at the moment to do so, to erect capital stations.

Mr. RIDER said that summed up the position exactly as he would wish.

Sir JOHN SNELL said the only difficulty he saw about that was that it would take some time to prepare to construct a new capital station.

Mr. RIDER said it was not inconceivable that the Joint Authority might have to begin to prepare for the first capital station during the first stage of the organisation. It was impossible to bind the Joint Authority now to any definite line of action. No matter who brought in a scheme at the present time, it might be materially altered in five years.

Mr. C. D. JOHNSON, Controller of the L.C.C., followed, and was asked only a few questions on the financial side of the scheme by counsel for the L.C.C. Generally speaking, he said, the finance had been estimated on the basis that it would have the rates of the area behind it, and that the income would be the whole income derived from the generation of electricity. The rate at which the money for the new capital stations and other works would be raised had been taken at 6½ per cent.

The cross-examination by counsel for the Conference of Local Authorities and the companies promoting similar schemes was devoted to points of detail. It was not contemplated, said Mr. Johnson, that there would be a flat rate of charge over the whole area, although, unlike the local authorities, the L.C.C. had not considered a system of charging according to zones. Another difference between the two schemes pointed out referred to the meeting of possible deficiencies in the working of the Joint Authority. The L.C.C. proposed to have a reserve fund whilst the local authorities proposed to make a levy to wipe off any deficiency, as it arose, the levy being in proportion to the number of kWh taken by the distributor from the Joint Authority.

Mr. KENNEDY, for the companies, speaking on the finance, said the idea was that the companies should advance money to the Joint Authority, and the interest on it would be guaranteed by the L.C.C. under Clause 4 of the Electricity Supply Bill (No. 2) when it became an Act.

Many questions were put by Mr. DONALD, for the East London scheme promoters, as to the finance of the scheme.

For the Metropolitan Electric Supply Co. and the North Metropolitan Electric Power Co., it was put to witness that under the scheme, these concerns would be permitted to do what Parliament had already authorised them to do; they would not be benefited in any way, and yet would have to bear a share of the administrative expenses in the early years.

Mr. JOHNSON's reply to all questions of this character was that everybody in the area would reap the benefit ultimately.

The Inquiry was then adjourned.

Mr. JOHNSON was re-examined on the morning of Tuesday, June 21st, by Mr. Craig Henderson, K.C. The first point dealt with was the payment for the undertakings by the Joint Electricity Authority in stock, provision for which was made in the financial scheme. As to the Joint Authority becoming a second Metropolitan Water Board, there was no similarity between the two. The Water Board supplied in detail, whereas the Joint Electricity Board would not supply in detail; and the fact was that the administrative expenditure of the Water Board had risen from 8¼ per cent. to 10¼ per cent. as between 1913 and 1919.

Sir HARRY HAWARD asked what was likely to be the total amount of capital required to meet the needs of Greater London, would it be £50,000,000 in the next 20 years?

Mr. JOHNSON thought a figure of from £40,000,000 to £50,000,000 would be a reasonable one. Discussing with Sir Harry the relative ability of the railway companies and the Joint Authority to raise capital, Mr. Johnson said this should be 1½ per cent. in favour of the Joint Authority. The whole basis of the scheme was that it should be self-supporting. As to a guarantee of the interest on capital by the L.C.C., he thought this would have a greater effect upon raising money than a guarantee from a number of smaller local authorities. Asked as to the position if the larger outside authorities refused to come in, witness said that although the L.C.C. would prefer the co-operation of the other large authorities, it did not necessarily follow that the L.C.C. would not proceed alone if they held back. If other local authorities refused to pledge their rates as security for the capital required by the Joint Authority, he sympathised with the view put forward at another inquiry before the Commissioners, that such authorities should not have the same favourable terms for bulk supply as those authorities which did pledge the security of their rates.

Reverting to the raising of capital by railway companies and the Joint Authority, Mr. Johnson said the difference in favour of the Joint Authority would depend upon whether the Authority had the security of the rates or only of its undertaking.

Sir HARRY HAWARD mentioned that the Yorkshire Electric Power Co. and the Notts. & Derbyshire Power Co. had put interest and depreciation at 12½ per cent., whereas in the case of the Joint Authority the total, with the rates as security, had been put at 9 per cent. The County of London Co. with regard to its Barking scheme had estimated 11 per cent., including depreciation.

Mr. JOHNSON said he should have thought capital could have been raised more cheaply than this by companies.

The position of the railway companies was then considered in this connection, and Sir Harry Haward said it seemed hardly likely that the railway companies could raise capital so cheaply as the Joint Authority.

Counsel for the railway companies interposed to the effect that the ability of the railway companies to raise capital

on present earning capacity, under Government control, would be materially improved after Government control was removed. That was a material factor in the case from this point of view.

Mr. JOHNSON'S own opinion was that if the Joint Electricity Authority could get to work soon enough it should be able to provide stations which could supply energy to the railway companies as cheaply as the railway companies could generate it for themselves. That opinion was based upon the fact that the cheaper rate at which the Joint Authority could raise capital would more than counterbalance the lower rate of depreciation adopted by the railway companies. At the same time, the period for repayment of loans by the Joint Authority should be made as long as reasonably possible. He did not, however, suggest that a longer period should be granted to the Joint Authority than to the local authorities generally for electricity undertakings, but the period in all cases should be made as long as possible in order to enable electricity to be sold as cheaply as possible.

Sir HARRY HAWARD then pointed out that under the proposed heads of agreement for the purchase of the undertakings by the Joint Authority was the payment of the original capital expenditure properly standing in the books, less depreciation on buildings, plant, and machinery, according to a scale to be settled by the Commissioners.

Mr. JOHNSON said this was primarily intended to apply to the companies and applied only to generation.

Mr. CRAIG HENDERSON, K.C., said the companies were compulsorily purchaseable, but it would be open for any local authority to agree with the Joint Authority for the sale of its generating plant on similar terms. It was not intended to apply the agreement compulsorily to the local authorities.

Sir HARRY HAWARD said the point was whether these terms were considered fair and proper for local authority undertakings.

Mr. JOHNSON said the L.C.C. had not considered the heads of agreement put forward as applying to local authorities. The basis of the heads of agreement was to give the companies, who were compulsorily purchaseable, an extended tenure of life as distributors.

Sir HARRY HAWARD said the matter had been given so much consideration that he should have thought the L.C.C. would have made up its mind how it would deal with the local authorities. If the terms offered to the companies were to be offered to the local authorities, they seemed extremely favourable.

Mr. JOHNSON said he should think some arrangement would be come to with the local authorities to take over their capital debt, and not to pay a capital sum for the undertakings.

Sir HARRY HAWARD said that if the Joint Authority paid in stock or cash, for the local authorities' undertakings, the capital would have to be raised at 6½ per cent., and this would place the local authorities in a very favourable position, and, indeed, give the local authorities a profit on the transfer, and would constitute a burden on the Joint Electricity Authority's undertaking.

Mr. JOHNSON agreed that that should not be done.

Sir HARRY HAWARD then passed to the companies which were to be paid in capital or stock. The companies had raised a large amount of capital at a good deal less than 6½ per cent., and they would derive considerable benefit.

WITNESS agreed, and Sir HARRY HAWARD then took witness through the financial clauses of the scheme, and pointed out that the Treasury would not allow borrowing by Bills, and it was not proposed to give that power in the Electricity Supply Bill. Criticism was also made of the proposal that the Joint Electricity Authority should have power to borrow up to £1,000,000 without consent. Sir Harry next dealt with the point that many authorities would not get any benefit from the scheme, and invited witness to go into some detail on this.

Mr. JOHNSON said these authorities on the fringe would get no immediate benefit from the scheme, but by being members of the Joint Authority they were in a sense insuring themselves for the future. The duty of the Authority would be to look ahead and provide for the needs of the whole area, and by this supervision the whole of the undertakings would ultimately benefit, when the scheme was fully developed.

During the course of these questions, Sir HERBERT NIELD, K.C., remarked that he did not think the Electricity Supply Bill (No. 2) would be saved. This, of course, had a bearing on the possibility of the L.C.C. and the local authorities giving financial assistance to the Joint Authority.

Mr. PAGE suggested that the better plan seemed to him to be for the Joint Electricity Authority to rent the stations from the existing authorities with the right to install new plant and also with the option of purchasing the station at a later date rather than for the existing authority to continue to run the station and rent new plant from the Joint Authority, as proposed in the scheme.

Mr. FRANK HUNT, head of the Estates and Valuation Department of the L.C.C., said that the rateable value of all existing London electricity supply stations, including distributing systems, was £544,000, and the total capacity was 358,000 kW, which worked out at 30s. 5d. per kW. The average assessment of all generating stations in the county was 14s. 3d. per kW. By 1925, he estimated the rateable value would be £356,000. The position would be different when the undertakings were separated, and the whole of the generation placed in one hand and the distribution in another. Generally speaking, there should be no difference in the total contribution, but if the Joint Authority were regarded as quasi-distributor, it might be that the rateable value of the stations would be increased.

Sir JOHN SNELL put several questions on this point, and seemed somewhat surprised at the possibility. The Commissioners, he said, did not want to bring about a separation of the ownership of the undertakings which would bring in a larger contribution to the rates and place a heavier burden upon the users of electricity.

Mr. HUNT said the area was within the jurisdiction of four or five different Quarter Sessions, and they did not always agree as to the basis. At the same time, it was a serious risk of increased rates which all undertakings had to face, and it might be hastened by a transfer. It often happened that the rateable value of an undertaking in parts was higher than the rateable value of the undertaking as one whole.

Cross-examination rather indicated that the suggestion of the witness was an indication of the possibility, and that there was nothing to prevent rating authorities attempting to put up the rateable value without the Joint Electricity Authority coming into being and taking over the power stations.

This closed the case for the L.C.C. scheme.

(To be continued.)

THE ELECTRICAL CABLE INDUSTRY.

A REPORT prepared by a sub-committee appointed by the Standing Comimttee on Trusts was published last week, as noted in our columns (Cmd. 1,332, price 1d.). The terms of reference were: To inquire into the existence of any combination of makers of and/or dealers in electrical cables and the materials used in the manufacture thereof, and into the effect which their existence, if found, has upon supplies and prices.

The report states that the electrical cable industry in this country has been a prosperous one for many years, and, unlike many other trades, has not suffered any serious effects from competition from abroad. This may be accounted for by the facts that the trade is highly organised and that British manufacturers enjoy a world-wide reputation for the quality of their products, to which many witnesses have borne testimony. Good quality in this industry both in workmanship and in the use of the best materials is essential if interruptions in electricity supply are to be avoided, and it is on this basis of quality that British manufacturers have been able to secure a steady demand for their productions notwithstanding the considerable competition that exists.

The percentage increase in the price of cables over pre-war prices may be fairly stated as being approximately only 50 per cent. in the case of certain cables for indoor use, and approximately 100 per cent. in the case of heavy underground cables. These percentage increases in prices are moderate when compared with those of many other commodities.

The sub-committee has found no actual combination of firms controlled by one central organisation from the point of view of capital and output, but there are in existence in the trade several associations of which the following are the most important: The Cable Makers' Association, the Telephone Cable Makers' Association, and the High Conductivity Copper Association.

The principal of these is the Cable Makers' Association, which commenced its operations in 1899. The initial object of the association was to nullify the danger of deterioration in the quality of rubber insulated cables brought about by the severe competition then existing amongst manufacturers. With this end in view the dimensions of conductors and thicknesses of dielectric and lead coverings were standardised, and were generally accepted throughout the industry. In addition to the standardisation of dimensions, tests of performance of the cables, conditions of contract and forms of tender have also been formulated in co-operation with certain other bodies interested in the industry. The policy of the association generally has been to secure standardisation, and with this object it has for some years co-operated with the British Engineering Standards Association. Most of the largest manufacturers of cable in this country are members of the association, and the combined capital of the members represents approximately 80 per cent. of the total involved in the industry, whereas the output of the Association has been represented as being approximately 90 per cent. of the total production of the country. Considerable sums of money have been, and are being, expended on research work by the Association and its members, although the result of the research carried on individually is not always communicated to the remaining members.

A further object of the Association has been to regulate the wages and working conditions in the industry, and a Joint Industrial Council has recently been formed and agreements come to between the Council and the Trade Unions concerned whereby the grading and wages for the various occupations in the industry have been standardised.

The Cable Makers' Association is registered as a trade union, and under the Trade Union Act, 1913, is not permitted to

exercise any price regulating functions. Standard prices of cables of specified qualities and grades are, however, agreed upon by the members, and standard price lists are issued from time to time. Maximum discounts are also fixed by agreement, and no member is allowed to sell below the agreed prices or give higher rates of discount than those fixed. Various discounts off the list and catalogue prices are allowed according to the channel of trade, and amongst other inducements offered to buyers may be mentioned an exclusive buyer's bonus of 5 per cent. given to certain purchasers who agree to purchase specified cables exclusively from the members of the Association. Contract rebates varying from 1¼ to 10 per cent. are also given to certain purchasers in consideration of their agreeing to purchase from members of the Association specified net values over a given period. There is in existence an important agreement between the Cable Makers' Association and the Electrical Contractors' Association, whereby the latter association receives further special benefits subject to exclusive buying and other conditions.

The electrical cables industry is not entirely under the control of the Cable Makers' Association, and there are old-established firms of repute outside the association which are in competition. The prices quoted by non-associated firms for types of cable similar to those produced by associated firms may be fairly stated as being generally about 10 per cent. lower than those of the associated firms.

Non-associated firms represent the quality of their productions to be equal to that of associated manufacturers, and various opinions have been expressed by buyers as to their respective merits.

It is abundantly clear to the sub-committee that manufacturers operating outside the association are well able to compete with the associated firms from the point of view of quality, and this is an important point. The outstanding fact remains, however, that the largest users, as a rule, are entirely satisfied with the service rendered by associated firms and are willing to pay a higher price for their products which they regard, rightly or wrongly, as in the nature of an insurance against interruption of electricity supply from failure in service and as a guarantee of durability.

The prosperity of the electrical cable industry has already been referred to, and there is no doubt that this prosperity was largely created by the Cable Makers' Association which, by its organisation and research, initiated and has since maintained a high standard of quality, thus securing the confidence of buyers both in this country and abroad.

The sub-committee has no evidence to show that the association has acted or is acting unreasonably, and it is noteworthy that during the course of the inquiries there has been a marked absence of hostility towards the association both on the part of users and on the part of non-associated firms. Even if there should be any risk of unreasonable action in the future, the public would be sufficiently safeguarded if the recommendations contained in the report of the Committee on Trusts, dated April 24th, 1919, were adopted.

The Telephone Cable Makers' Association is an unofficial (informally constituted) organisation, and distinct from the Cable Makers' Association, although all its members are also members of that association. Prior to 1904, and during the time when the greater part of the telephone service in this country was owned and operated by the National Telephone Company, competition amongst the few manufacturers engaged in the industry was so keen as to make production unremunerative. With a view to obviating this, and also to meeting competition from abroad, three of the principal manufacturers "came together" and were joined by a fourth in 1907. From this time the association may be deemed to have been in existence, although until recently it has been more in the nature of an understanding between the members than a formal association. The output of the association is approximately 95 per cent. of the total in this country, and there is only one firm outside the association able to compete to any appreciable extent.

The Post Office purchases the bulk of the output of the members of the association, and it may, therefore, be said that the operations of the association are principally confined to dealings with this department.

Since the formation of the association, its principal functions have been to arrange selling prices and to allocate to its members orders of an agreed percentage of the total. With regard to this latter function a system was adopted whereby a member, to whom an order had been allotted, was protected by somewhat higher tenders on the part of the remaining members. While this system is still in operation, the sub-committee is informed that, so far as the Post Office is concerned, members now submit uniform prices and that department is at liberty to allot the work where it can be executed with the maximum advantage.

It appears that the Post Office has not always been satisfied as to the reasonableness of the prices submitted by members, and such dissatisfaction was expressed in 1920 consequent upon certain increases which were not considered justifiable. The Post Office discussed the subject with a representative of the association who agreed, with a view to the Department ascertaining whether or not the prices were reasonable to allow an independent accountant to examine the books of one of the members upon the basis of whose costs, it is understood, prices have always been submitted. A certificate was later submitted to the Post Office to the effect that the margin of profit shown in the prices was reasonable. As the result of these negotiations an agreement was arrived at (and is now operating) whereby the price governing cable contracts between the Post Office and the Telephone Cable Makers' Association was to be based upon the ascertained cost of manufacture at an efficient factory plus a certain percentage for manufacturers' profit. The sub-committee has been informed by a representative of the association that the margin of profit agreed upon between the Post Office and the association has never been exceeded since the formation of the association in 1907. The sub-committee has no reason to doubt this statement, nor any evidence to point to any unreasonableness on the part of the association.

The High Conductivity Copper Association is an organisation of manufacturers engaged in the drawing of copper wire for supply to the electrical cable industry. The basic material used in manufacture is wire bars, and the price at which drawn wire is to be sold is settled by the association which decides from time to time what amount is to be added to the price of basic production in order to arrive at the price of wire. The object of the formation of the association, in 1903, was to stabilise prices on the basis of a reasonable profit such as would not be likely to stimulate competition from abroad. The association represents that this policy has been consistently carried out, and that since the war such additions have been made to the margin as would cover only increased costs of production.

The report is signed by Messrs. J. E. Baker, O.B.E., P. J. Agnew, G. W. Bailey, Sir A. F. King, Messrs. C. H. Wordingham, C.B.E., and J. F. Mason.

LEGAL.

Hastings Corporation and The Tramways Co.

Mr. William W. Szlumper, M.Inst.C.E. (of Westminster), as arbitrator, sat at the Surveyors' Institution, Westminster, on June 18th, to hear a point of controversy in the matter of the relighting on the line of tramways on the Front, which the Tramway Co. has to undertake under its Act of last year. The Act authorised the company to erect overhead wires for working the tramways on the Front in lieu of the then existing petrol-electric system. A question has arisen whether it is the duty of the Corporation or the company to supply a new or supplemental cable in connection with the relighting. The Corporation contends that it is the duty of the company; on the other hand, the company says it is not its duty to do so.

Mr. Macmorran, K.C., and Mr. Lawrence Tooth (instructed by Mr. Percy Idle, town clerk of Hastings) appeared for the Corporation, while Mr. Roskill, K.C., and Mr. H. G. Robertson (instructed by Messrs. Ashurst, Morris, Crisp & Co., solicitors, of Lombard Street, E.C.) represented the Tramway Co.

In opening the case, Mr. Macmorran said that the Corporation, in giving up its objection to overhead wires, made an agreement with the Tramway Co. under which the latter was to substitute a new system for the old system of arc lighting. The company was to provide lamps to be placed on its posts and, at its own expense, as the Corporation might require, provide everything for the purpose.

Mr. Roskill submitted that the question to be decided concerned two points of law. The question was not whether the existing cable was sufficient or insufficient, but having regard to the words of the Act of Parliament, whether the liability which it was sought to put upon the company was a liability imposed by the Act. That was a question of law, and he submitted, therefore, that no evidence was admissible on whether the lighting cable of the Corporation was sufficient or insufficient for this or any other system. Apart from that, there was a question of law whether this came within Section 33 of the Tramways Act, 1870, and was subject to arbitration.

Mr. Macmorran contended that in so far as any new cable was necessary it was the duty of the company to supply it; whether it was necessary must depend upon whether the existing system was sufficient or not.

Mr. Roskill said the short point was whether the word "cable" in the section included part of the Corporation's main cable.

The Arbitrator: The position is this, I suppose. Is the company to pay the cost of a cable such as is required by the Corporation? I gather that the lighting which originally existed has now been altered to a different system.

Mr. Roskill: Not at our request. We could adapt. That is not our doing.

The Arbitrator: Exactly, a different system. It comes to this, surely: The Act of Parliament does not put on the company, so far as I can see, an obligation to adopt a different system to that which was in force prior to the passing of the Act. I should like to know at whose instance it was that an alternative, altered, system was agreed to, and surely that will have a material bearing upon Mr. Macmorran's point.

Mr. Macmorran: I am afraid, sir, you have got to interpret the section as it stands, and therefore you cannot go into details of what negotiations took place for the pur-

pose of arriving at this agreement. Section 6 really represents the agreement come to between the parties on the Corporation's opposition, and that agreement has been made a sub-section which is entitled "provision for the protection of the mayor, aldermen, and burgesses of the county borough of Hastings." They were to have some protection against proposals which had been made by the company. The company wanted to remove the restrictions which hitherto had been placed upon it, and in consideration of the Corporation consenting to its proposals these provisions under Section 6 were inserted for the protection of the Corporation. What we say is this: The protection of the Corporation involved the abolition of its existing system of lighting, and substituted something else. That was intended to be done at the expense of the company. Sub-section 3 says: "The company shall at their own expense provide all necessary cable, wires, appliances, and apparatus in connection therewith."

Mr. ROSKILL submitted that if it was to be left to an arbitrator to decide what was necessary this would have appeared in the section. The clauses were the Corporation's own clauses.

The ARBITRATOR did not see how they were going to eliminate the word "necessary" as a point of fact.

Mr. C. H. WORDINGHAM, C.B.E., was then called on behalf of the Corporation. He said he had inspected the sea Front, and considered the clauses of the Act of 1903 and 1905. The present system of lighting consisted of an arc lamp on its own special pole. The current was transmitted along the sea front at a pressure of 600 volts, and was transformed down at each post to a pressure suitable for the arc lamp, approximating 50 volts. By switching off and on at a single point there was a double saving of labour. He had read the Act of 1920, and knew it was proposed to make what he might call a new system of lighting on the front; it was a substitution of another complete and different system for the existing system of street lighting. In order that the new system might be equivalent to the old one they must provide for a greater consumption. There must either be a new cable or the existing one must be supplemented. The most economical way would be to supplement the existing cable along a portion of the Front.

In cross-examination by Mr. ROSKILL, Mr. Wordingham thought the agreement prevented the old arc lamps being put on new standards.

Mr. ROSKILL: You say the Corporation, through this agreement, seeks for a better system of lighting than it had before?

Mr. WORDINGHAM: No. I am not prepared to say it is a better system. It is a better distributing system, and there are more lamps.

In further cross-examination, Mr. Wordingham did not think the cost entered into the question of the company having to carry out its undertaking.

Mr. ROSKILL: There is no difficulty in transferring an arc lamp from one standard to another.

Mr. WORDINGHAM: You can't transfer it directly to the standard. You must have a bracket to stand it on.

Mr. MACMORRAN said this suggestion of his learned friend could not be serious because the Act provided for the substitution of another system of lighting.

This was the case for the Corporation.

Mr. ROSKILL, in addressing the Arbitrator for the Tramway Co., said the only liability of the company was to make the necessary connections with the new standards. First, the company had to place on the posts and standards erected by it as the Corporation might require, electric lamps in substitution for the existing electric standards and lamps. Next, the company, at its expense, had to provide, fix, and properly connect all necessary cable, wires, appliances, and apparatus in connection therewith. That provision clearly dealt with fitting and not constructive work. The next clause was: "The Corporation shall be entitled to the use of such posts and standards for the said lamps, cables, wires, appliances, and apparatus free of cost." The word "cables," he submitted, in this connection had no reference to the main cable. How could it include the main cable which already belonged to the Corporation? It must be something to the use of which it would be entitled free of cost. There was not a single word in any of the clauses that could be interpreted to mean the provision of a new cable. Further, the company was to remove all these things if required to do so. How could that possibly refer to a main cable?

The ARBITRATOR: You say the "cable" in this clause means that portion of the attachment between the cable of the Corporation and your lamp standard.

Mr. ROSKILL: Entirely. That is the whole point.

Mr. WORDINGHAM did not think the attachment from an engineering point of view could be called a cable, for the reason that the current to be carried would be very small.

Mr. ROSKILL (to the Arbitrator): As this gentleman uses the word "cable," will you ask him if he would say whether it does or does not include something attached to or connected with the standards or posts?

Mr. WORDINGHAM: The cable can be attached to a standard or post, but it cannot be connected to it. It must be connected to the lamp.

The ARBITRATOR: What you call a cable is some portion of that which lies between the Corporation cable and the lamp?

Mr. ROSKILL: Yes.

Mr. ROSKILL then argued at length in support of his contention that this was not a question for arbitration under Section 33 of the Tramways Act, 1870, as the matter in question did not come within its purview.

Mr. ROBERTSON also addressed the Arbitrator on behalf of the Tramway Co.

Mr. MACMORRAN having replied, the ARBITRATOR reserved his award, saying he would state it in the form of a special case for the consideration of the High Court, and adding: "Mr. Roskill desires me to put into it his objection to my jurisdiction and his objection to the evidence. Therefore, if my award happens to be in Mr. Roskill's favour, he will have to argue against it."

INFRINGEMENT OF RESTRICTION ORDERS.

AT the Halifax Borough Court on June 13th, three cases were heard in which it was alleged that the restrictions placed upon the use of electricity had been ignored. In the first case the defendants were Messrs. Ollerenshaw, Ltd., spinners. It was stated that this firm's weekly consumption since the Order was made had exceeded by 43 per cent. the average weekly consumption prior to April. The defendants said that they thought they were keeping well within their limits as their machinery had only been running for half the usual periods. They disputed the Corporation inspector's figures for their consumption prior to the Order, and said the error was probably due to the meters. The case was dismissed on payment of 12s. 6d. costs.

Messrs. Samuel Barrett & Son, slaters and plasterers, who were alleged to have used 154 per cent. of their normal consumption, but who stated that their working hours had been reduced by half, were similarly dealt with.

Frank Earnshaw, joiner, was stated to have used 151 per cent. of his normal consumption. He explained, however, that this was due to the fact that he had replaced a 5-h.p. motor by another three times this capacity, but had been given no opportunity to explain the circumstances. The Bench dismissed the case without costs.

TRAMCAR DRIVER FINED.

AT Bradford, on June 15th, William Henry Wilkinson, a Corporation tramcar driver, was fined 10s. for driving a car to the danger of a policeman on point duty in Wakefield Road. After giving a signal for the car to stop, the constable turned round to attend to other traffic, and he was knocked down by the tramcar. The defendant said he could not pull up in time. The defence was that there had been an error of judgment, but not wilful negligence. The defendant had a good record in the tramway service.

BASTIAN ELECTRIC CO., LTD.

THE petition of W. F. N. May and Another for an order for the compulsory liquidation of this company was mentioned to Mr. Justice P. O. Lawrence in the Companies' Winding-up Court on Tuesday.

Mr. DIGHTON POLLOCK said there was a definite proposal to settle the matter, and he understood that that involved the payment of a certain sum, and the only question was as to the date to which the petition should be adjourned to allow of the payment being made.

Mr. SCHWABE, K.C., for the company, said he was instructed to say that the matter would be carried through if the petition was allowed to stand over for a fortnight.

His Lordship adjourned the petition accordingly.

ELECTRICAL BELT CASE.—IMPORTANT IRISH DECISION.

IN the High Court of Appeal in Ireland, Dublin, before the Lord Chancellor, Lord Justice Ronan and Lord Justice O'Connor, an appeal was heard from an order of Mr. Justice Gordon refusing liberty to issue and serve a writ out of the jurisdiction on Ajax, Ltd., London, the intention being to try in Dublin an action against the company by Edward McPhillips, jeweller, Bundoran, Co. Donegal, who had been supplied with an electrical belt at a cost of £21, and who now alleged that the article was worthless.

Counsel for plaintiff informed their lordships that the belt was intended, he believed, as a cure for kidney disorder. The plaintiff proposed to examine a number of witnesses—electrical engineers and others. Mr. Justice Gordon had refused liberty on the ground that the sum involved was too trivial to justify the bringing of people from England; but this Appeal Court had granted liberty in a claim for £10 10s.

The Lord Chancellor said they were bound to have regard to the convenience of the defendants and the expense that they would have to incur in coming to Dublin. They were receiving constant complaints from English and Scottish mercantile associations that their members had to come to Ireland in small cases at enormous expense. This was a case that could well be tried in the County Court of Middlesex, and they must dismiss the appeal.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Living Expenses Abroad.

Very many engineers, especially those who are in the early days of their career, and who have come to the conclusion that the only way to advancement is by taking up a post abroad, must be grateful to you for your articles on "Living Expenses Abroad," and hope that from time to time they will be added to.

There is, however, one point, and rather an important one too, that has been overlooked, and which the writer thinks should always be stated, and that is the social position of the correspondent.

It must be obvious that a salary which would give comfort and luxury to one type of man would not be enough to make ends meet in the case of another. Take India as an example. A young engineer going out whose position at home is one of more or less humble circumstances, would not expect, and probably could not live, in a manner similar to one whose social position was higher, and consequently if he is good enough to send home data of his living expenses, which are very welcome here, they would not afford much of a guide to a man of the type described to-day rather aptly as the "new poor," who would reasonably expect to live in somewhat different circumstances; or even for the matter of that to a man of any other class.

To send such a man out on a salary based on the lower scale would be unfair to the man himself, and would react on the employer who sent him, as the result could only be that he would very soon become dissatisfied, would necessarily lose caste in the eyes of the natives with whom he came in contact, he would no longer be looked up to as a "Pukka Sahib," and would become yet another link in the chain of lost prestige which is, alas! so prevalent in our Indian Empire of to-day.

A short statement by the correspondent as to his social position (the type of club he belonged to, for example, would enable readers to locate him) would add 100 per cent. to the value of the information, and would be very greatly appreciated.

Ubique.

June 14th, 1921.

The Cost of Living in Spain.

I am anticipating being sent to a village in the neighbourhood of Madrid shortly, to superintend the installation of electrical plant. Could you give me information which might be of assistance to me, such as cost of living, general conditions, &c.

Rover.

June 17th, 1921.

[We have no data bearing directly upon this matter; perhaps our readers will kindly assist our correspondent?—EDS. ELEC. REV.]

Electric Light Wiring Systems.

Referring to the paper read before the National Association of Supervising Electricians, I would like to give your readers my experience of screwed conduit and lead-covered cable.

In one portion of a church building cables were run underground in screwed conduit which was surrounded with cement. This system gave trouble from the very start, as, owing to condensation, the cables were lying in water, and in a week or two burnt out. After this, cementing the ends of the tube up was tried, bringing the cables through airtight bushes, but this was worse still.

Finally the whole of the cable was taken out and lead-covered cable was put in its place. This was done about 17 years ago, and we have not had any trouble since then.

Also, I should like to say that my experience is that wood casing is far cheaper than screwed conduit for ordinary work, and often cheaper than the grip system.

J. M. Ward.

Leeds.
June 14th, 1921.

The paper read before the meeting of the National Association of Supervising Electricians is not of a nature to inspire the general electrical world to confidence in them.

In the first place, it is equivalent to biting one's nose to spite one's face. The supervising electricians depend to a large extent upon the manufacturers of various wiring systems for their daily bread; it is, therefore, to their interests to support the manufacturers, rather than to criticise them, or their products. Particularly noticeable is the criticism shown towards the well-known C.T.S. cable. Some people prefer C.T.S. wire, while others do not, at the same time it will not benefit the Association of Supervising Electricians to condemn C.T.S. cable in a larger degree than any other system.

I would suggest to Mr. Alldread that the reason for the C.T.S. wire cracking at bends and corners is not due to the cable itself, but to its having been installed with unduly sharp bends. Also my experience is that C.T.S. wire is very flexible and is not liable to crack, at bends, when properly installed. Again, I would call his attention to the statement that on horizontal runs sagging is unavoidable; the system is a neat job when properly installed.

Why does Mr. Alldread condemn C.T.S. cable when he admits he has no experience of it? I ask him to answer the last question.

The wiring system to suit all minds and tastes has yet to be born, so the matter is one for the particular person concerned to suit himself; the person who pays the piper generally calls the tune. At the same time, condemning C.T.S. cable more than another system is stupid, and engineers of some standing, and who are broad-minded, can well afford to ignore such discussions, that are all one-sided.

If Mr. T. Hough, another contributor, will kindly read his own article he will notice that he contradicts himself. He states that screwed tube, lead-covered, paper-insulated, lead-covered V.I.R. wood casing, and cab tire, are failures when in damp situations. He then states that in damp situations the only two systems that will stand up to it are cab tire and vulcanised rubber and stranded wire. I cannot say I favour his system of front recessed wood blocks for jointing purposes; warm situations, or exposure to the sun, would soon persuade the bottle wax to leave the job.

In conclusion, I would advise the Association of Supervising Electricians to adhere to the old proverb: "Judge not, that ye be not judged." Or, in any case, to judge fairly.

Two Phase.

June 20th, 1921.

Converting 50-cycle, 1,500-volt, Alternating to Direct Current.

With reference to "K.W.'s" letter under the above heading in your issue of the 10th inst., it is noticeable that he makes no mention of the large mercury arc rectifier, which is acknowledged to be the most suitable converter for such conditions at 1,500 volts d.c. Not only is it capable of dealing with these high pressures, but frequency has no bearing whatever on its operation. On the contrary, with a periodicity of 50 cycles, the efficiency would improve as compared with that obtained at 25 cycles and 1,500 volts d.c., which latter efficiency, as it is, is unapproached by any other form of converter.

M. A. R.

June 15th, 1921.

The Grading of Mains Engineers.

I was very pleased to note that someone had at last "taken up the cudgels" on behalf of the meter engineer. "Meter Engineer?" has summed up the situation quite correctly when he says that meter work has been for years looked upon as an insignificant occupation; and this in spite of the fact that it is upon the *insignificant meter* that an electricity undertaking's revenue depends.

It almost seems as if the meter engineer has, for far too long, hidden his light under a bushel. He certainly doesn't write letters to the technical Press belittling the work and efforts of his fellow workers in the electrical industry. Are we not *all* necessary for the successful working of an undertaking?

Unlike our American cousins, the average English electricity undertaking does not understand, or appears not to understand, how to run a meter department successfully. Incidentally, the best publication on meter engineering, in all its branches and ramifications, is, I am rather sorry to have to confess, American!

As you stated in your leading article of May 2nd, 1919, "every unit not properly metered is a dead loss, in money, to the undertaking." I wonder how many units, and incidentally, how much money, is lost, in this manner, in the course of a year's working, in the average English electricity undertaking.

No meter should be out on circuit without a thorough overhaul and recalibration longer than three years, and this period should vary inversely as the size of the consumer. That is, a large consumer should have his meter, or meters, checked much oftener than a small consumer.

I am afraid that I have let my pen run away with my enthusiasm in the above matter, but I really do think that it is about time that the meterman was recognised as equal to the charge or mains engineer.

Meter work entails just as much technical knowledge as does the position of charge or mains engineer; especially if the man in charge of the meters has the interests of the undertaking at heart.

It is in the hope that I may further the interests of the meter engineer that I am writing this letter, and signing myself,

Another Meter Engineer.

June 19th, 1921.

Re the E.P.E.A. schedule, I should like to point out to your correspondent "Grade 8," and any of those whom his

arguments may mislead, that his "constructive" criticism would be more than likely to prove very destructive in its practical application. To try to pack all the executive committees with shift men merely because they were shift men is a suggestion so fundamentally wrong in principle as to be utterly unworthy the second thought of any man calling himself an engineer. The obvious is very seldom the best way of doing anything. The E.P.E.A. is not merely a rob-the-ratepayers association (though that laudable object should never be entirely lost sight of, ratepayers as a class being mostly narrow-minded objectionable persons obsessed with "a narrowing lust of gold"), our Association is an exceedingly complex and delicate machine, the pioneer of its kind, with very far-reaching possibilities in its future; it is not to be lightly delivered into the hands of unskilful or hot-headed operators. The first question for every voter to ask himself is: "Who is the best man for the association?" and then, having got the best men at the head of things, keep them up to their job by continually demanding explanations of wrong actions or inactions. That's your part of the contract, your job isn't finished when you have recorded your vote; if you think it is you will deserve what you will get, which is "nothing." As to methods, attend all the meetings possible, but also by all means take full advantage of the generosity of the "Correspondence" column of the good old ELECTRICAL REVIEW, the "forum" of station men for 20 years past. There is nothing like publicity to "ginger up" public officials. In such a scattered association as ours any real "general" meeting is impossible, the technical Press is the only place for that full and free discussion of those vital problems whose correct solution is essential in order that "the truth shall make you free"—a maxim that should make a particular appeal to engineers who, above all men, spend their lives seeking the ultimate truth. I should like to add also in favour of discussion in the REVIEW that many junior members, rightly or wrongly, fear victimisation if they express their views too freely. I have had several cases brought to my notice, in every case, I am satisfied, purely imaginary, but nevertheless effective.

In my opinion the E.P.E.A. has been most skilfully navigated through some very dangerous storms, but "Grade 8" remains *de*grading and insulting, and a menace to the status of the whole profession.

C. S. W.

June 20th, 1921.

The Lubrication of Ball Bearings.

I was much interested in reading Mr. J. C. Todman's letter in your issue of the 17th inst. It is high time the question raised by your correspondent was fully ventilated, and I hope settled finally. As an expression of personal experience, I consider ball bearings as applied to electric motors, as being little better than an abomination, as compared with a sleeve bearing bush and ring lubrication. A well-made ball bearing equipment, well packed with Stauffer grease, will render the best of service for a long while, provided the situation is suitable. Petroleum jelly, even with graphite admixed, does not meet with my personal approval, though quite good results are obtainable with this when applied to "toy motors." Light machine oil should be barred entirely, as in a very large number of cases "freak pulleys" form part of the motor equipment, and consequent belt tensions frequently militate against satisfactory results. Personally I plump for grease cups and Stauffer grease, to the exclusion of all else, particularly in view of the faulty material and workmanship found generally nowadays, particularly with small single-phase motors.

Walter E. Rogers, A.M.I.E.E.

Shepherds Bush, W. 12.
June 19th, 1921.

Situations Vacant.

I should be obliged if you would give me space in your "Correspondence" column to bring to the notice of station engineers an advertisement which appeared under the heading of "Situations Vacant" in your last issue. It reads:—

"Mains Superintendent, installation and maintenance, h.t. and l.t. networks, supervision mains and meter staff, maps, necessary statistics; also good knowledge turbines, reciprocating sets, water-tube boilers, Weir pumps, &c."

The advertiser then proceeds to conceal his identity under No. 2398!

If he wants a "Chief Assistant Engineer," why not advertise for one? The advertisement as worded gives the impression that he wants a Grade 1 chief assistant at a Grade 3 rate.

Would a knowledge of book-keeping and shorthand be an additional advantage, as the successful applicant could then do the office work in his spare time?

June 20th, 1921. Justitia Fiat.

BUSINESS NOTES.

Bankruptcy Proceedings.—PHILIP DOWNIE, 355A, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea, Essex, electrical engineer and factor.—The receiving order in this matter was made on May 18th on creditor's petition. The statement of affairs shows liabilities to unsecured creditors £491, against assets estimated to realise £367, from which £2 9s. has to be allowed for preferential claims, leaving net assets of £365, or a deficiency of £126. Debtor attributes his position to becoming liable for goods supplied to a limited company, and the failure of that company to pay the accounts. It appears that on April 1st last debtor executed a deed of assignment to a trustee for the benefit of his creditors. He was brought up to the trade of an electrical engineer, and commenced his present business in January, 1920, at 355A, Westborough Road, with £50 savings. The only books of account kept consist of a sales ledger and a duplicate invoice book. Debtor became aware of his position on March 14th last.

FRANCIS EDWARD JAMES PADMORE, Marlborough Road, Nuneaton, Warwickshire, electrical contractor.—The following are creditors in this case:—

Metallic Engineering Co., Ltd.	£133	Wilson, G., & Co...	£15
Parsons, Sherwin & Co., Ltd. ..	18		

LESLIE PHILIP HOWSE, and GEORGE HARRY BERTRAM SNELL, electrical engineers (trading as Howse & Snell), 6 and 8, Duke Street, Margate. The following are creditors herein:—

Braulik, G.,.. : .. :	£48	Elec. Heating & Hardware Co.	£20
Bligh, S. W., ...	356	Anderson Bros.	10
Selyn Electric Co...	169	Bigg, E., ...	20
Thanet Advertiser	13	Brown, A., ...	42
Gestetner, D., ...	41	Rapson's, Ltd.	11
Napier Kimber, Ltd.	130	Hunt, J. W., ...	51
Holophane, Ltd.	23	Snell, F. C.,..	865
Mann & Overton	140	Chapman, A., ...	70
Sloan Electrical Co., Ltd. ..	57	Bligh, S. W. (for Rice & Sons)	40
Kent Coast Motor Co.	46	Suttie & Suckling	10
Fricker, V. D., ...	13	Poxon & Co.	14
Oldby, Ltd...	11	Millsum, care of Maison Elise	24
Rex Imports Co.	24	Cole & Hardie	82
Barratt, G. R., ...	12	Dredge, E.,..	25
Davis, J. M. (for Commercial Elec Co., Chester)	24	Powell, W. J., ...	105
Davis, J. M., as above	13	Jarladium Garage, care of Noble & Co.	47

J. F. LYONS, electrical engineer, Consett.—Trustee (Mr. A. E. Carr, 26, Collingwood Street, Newcastle-on-Tyne), appointed June 11th.

SAML. BECKETT, JUN., electrician, Deane Road, Bolton.—At Bolton Bankruptcy Court, on June 16th, bankrupt was examined on a statement of affairs showing liabilities of £281 and deficiency of £233. During his naval career debtor had experience in electrical work. After his discharge he was out of employment until he had exhausted his out-of-work pay. Then he started on his own account. Until October, 1920, he paid his way, but owing to trade depression the concern ceased to pay. He had been handicapped by the Corporation electricity department's delay in fixing meters. The examination was closed.

Company Liquidations.—SWARREN, LTD.—A petition for the winding-up has been presented to the High Court by the E.S. Co., Ltd. (Proprietors of the Electrical Supplies Co), of 233, Tottenham Court Road, and will be heard in London on June 28th.

BACHELET FLYING TRAIN SYNDICATE, LTD., and BACHELET LEVITATED RAILWAY SYNDICATE, LTD.—Meetings of members are called for July 20th, at 11, Ironmonger Lane, E.C., to hear an account of the winding-up from the liquidator, Sir W. B. Peat.

Dissolutions of Partnership. — RAINBOW MANUFACTURING CO., electrical welders, 75½, New Sumner Street, Birmingham.—Messrs. E. E. Hall & L. J. Austin have dissolved partnership.

S. SHERMAN & SON, gas and electric light fittings manufacturers, general factors, &c., 57, New Compton Street, W.—Messrs. E. E. Evans & E. Sherman have dissolved partership. Mr. Evans will attend to debts.

Trade Announcements.—The agency for the United Kingdom and Colonies for the Atlas Co., Ltd., of Copenhagen, makers of impulse steam turbines, steam engines, condensing plant, &c., has been taken over by MR. E. W. DOREY, of Norwich House, Southampton Street, High Holborn, W.C. 1.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, E.C. 2, inform us that they are now producing in large quantities for sale, the "Henley" adhesive tape, which for years has been made practically exclusively for their own use.

THE CREDENDA CONDUITS CO., LTD., are now handling Credenda cables and flexibles, and their new branch at Glasgow carries full stocks of Creda and Credenda lines.

MESSRS. R. M. RADIO, LTD., have removed from Whitefriars Street, E.C., to 5, Regent Square, Gray's Inn Road, W.C. 1.

MR. ARTHUR T. SMITH, A.M.I.E.E., of Albion House, Hanley, Stoke-on-Trent, has recently been appointed agent for the Midland Counties of England for Messrs. Bruce Peebles & Co., Ltd., for the sale of their electrical machinery. The counties covered by the agency are Stafford, Derby, Nottingham, Lincoln, Rutland, Leicester, Warwick, Worcester, and Salop.

Meeting of Creditors.—VIGERS BROS. (Frederick Vigers and C. H. Vigers), Balfour House, London, E.C. 2.—Meeting of creditors held on Tuesday, June 21st, to receive a statement of affairs.

Catalogues and Lists.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C. 2.—Leaflet 250, giving net trade prices of "Henley (504)" adhesive tape.

Messrs. Guy Chantrill & Co., 6, Norfolk Street, Strand, W.C. 2.—Stock list of motors for 50-cycle, three-phase a.c. 220-440 V. Fully priced.

Messrs. Reavell & Co., Ltd., Ranelagh Works, Ipswich.—Pamphlet No. 42 C, illustrating and describing "Axial" compressors and vacuum pumps especially suitable for electric motor drive.

The Overseas Engineering Co., Ltd., 163-165, Great Portland Street, W. 1.—List No. 63, illustrating and describing the "Garage" current converter for charging accumulators from a.c., and "National" lamp-testing meters. Also list No. 73, dealing with "National" moving-iron and moving-coil volt and ampere meters. Both lists are fully priced.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C. 2.—List No. L2492, giving illustrations and a full description of the "Kingsway II" miners' electric hand lamp. Also charging racks, standing racks, magnetic lock openers and other accessories. All items are fully priced.

Agricultural and General Engineers, Ltd., Central House, Kingsway, W.C. 2.—Publication No. 285, a well-illustrated descriptive catalogue of "Bull" d.c. dynamos and motors and complete lighting sets. The construction is very fully detailed, and the component parts are shown in every case.

The Falkirk Iron Co., Ltd., Falkirk. List No. 251, illustrating and describing "Falco" tailors' electric irons. Priced.

Messrs. Petters, Ltd., Westland Engine Works, Yeovil.—Publication No. 561 (36 pp.). A very full catalogue of "Petter Junior" oil engines, illustrating and describing many types ranging from 2½ to 8 b.h.p. The list is fully priced.

Hart Accumulator Co., Ltd., Stratford, E. 15.—A priced and illustrated leaflet advertising 5-Ah capacity ignition batteries in celluloid cases.

The Manor Works Co., 58, Albert Road, Aston, Birmingham.—A leaflet illustrating examples of sheet-metal pressings in aluminium, steel, brass, silver, &c., for all purposes.

The Photector Co., Ltd., Central Hall, Southall.—Leaflet E 2,030, giving illustrations, particulars, and dimensions of wrought-copper cable sockets. Prices and technical data are included.

Catalogues Wanted.—Catalogues and lists of electrical manufactures, also of oil and gas engines for electric lighting and other purposes, are wanted by Messrs. Bennett & Heron, of South-West Works, 46, Range Road, Whalley Range, Manchester.

Private Meetings.—A. M. Wilmore, trading as the Petlectric Lighting Co., High Street, Bordesley, Birmingham.—At a meeting of creditors a statement of affairs showed liabilities of £342 due to unsecured creditors. The net assets are £148, a deficiency of £194. The debtor made an offer of a composition of 10s. in the £. This was accepted, and a committee of the principal creditors was appointed.

Arthur Gray, electrical engineer, trading as Gray Electric Co., 9, Denmark Street, Charing Cross, W.C.—The creditors were called together recently, at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C. A statement of affairs was presented showing the position as at June 9th last, and this disclosed liabilities of £664. Of that amount £643 was due to unsecured trade creditors. The assets were estimated to realise £230, or a deficiency of £434. On behalf of the debtor an offer was made of a composition of 5s. in the £, payable as to 1s. 3d. in cash, and the balance by three equal instalments spread over a period of three months each, and guaranteed. The creditors decided to confirm the deed of assignment, and instructed the trustee (Mr. Osborn) to endeavour to obtain a cash offer of 4s. in the £, or, alternatively, 2s. in the £ in cash, and the balance in three months.

Receiver Appointed.—Quead, Ltd., 149, Southwark Bridge Road, London, S.E. 1.—Mr. E. A. Harpham has been appointed receiver and manager on behalf of the debenture-holder.

Tramway Workers' Wages.—As a result of the deliberations of the Joint Industrial Council for the Tramways Industry, an agreement was arrived at on June 16th. This provides that wages shall remain at their present level until the commencement of the first full pay period in August, after which revisions will be made at three-month periods. Taking the present wages as representing an equitable rate while the Ministry of Labour cost-of-living index figures remain at 135 per cent. above the 1914 level, a variation of 1s. per week will be made for each complete rise or fall of five points. For employés under 18 years of age, the variation will be at the rate of 6d. instead of 1s. This arrangement is to stand until December 31st, 1921, and three months' notice to terminate the agreement may be given by either party after this date.

Organised Propaganda.—We are informed that a new organisation, under the title of the Federation of British Propaganda Societies, has been formed, the object of which is to co-ordinate the work of propaganda societies and, as far as possible, prevent overlapping. Already about 15 propaganda societies have expressed their willingness to join. The Duke of Northumberland will act as President, and Sir Henry Birchenough, K.C.M.G., &c., is the treasurer. The general secretary is Mr. David Gilmour, O.B.E., Sicilian House, Southampton Row, London.

New French Companies.—There has been formed at Royan (Charente Inférieure) the Société Anonyme d'Energie Electrique (Force et Lumière) Secteurs de la Seudre, with a capital of 400,000 fr. in 100 fr. shares, 2,000 of which are apportioned to M. Henri Grenet, for his assets, namely, power stations at Royan and Mornac-sur-Seudre; buildings and lands at the latter place; material, tools, concessions, &c. In addition, he has been allotted 70,000 fr. in specie.

Trade with Siam.—The United States was the heaviest contributor of electrical goods and apparatus to Siam during the fiscal year 1919-1920, and it is believed that with greater enterprise Great Britain might easily improve her position. Owing to the fact that no electrical apparatus of any kind is manufactured in Siam, there is a demand for all classes of such goods, with the addition of specialities needed for a tropical country. The import duty on all electrical goods is 3 per cent. *ad valorem*. There are no other restrictions in this trade, and it is not required to have the country of origin stamped upon any articles sold in this kingdom. There has hitherto been no development of hydroelectric power in Siam, and in years with normal rice crops paddy husk is used for fuel, owing to its cheapness and the fact that the cost of oil, coal, and wood is comparatively high, as compared with neighbouring countries.—*Eastern Engineering.*

New Italian Companies.—There has been formed at Milan, with a capital of 1,000,000 lire, the Società "Osram," with the object of trade in and eventually manufacture of electrotechnical articles, and especially Osram, Wotan and A.E.G. glow lamps.

The Società Euganea di Elettricita has been formed in Venice with a capital of 10,000,000 lire. It is an offshoot of the Società Italiana Utilizzazione Forzeidrauliche del Veneto, the Credito Industriale di Venezia, and the Società Adriatica di Elettricita.

The Società Vercellese di Elettricità, with a capital of 6,000,000 lire, has been embodied at Vercelli for the purpose of the manufacture of electrical plant for agricultural uses.

Patents and Licences of Right.—Notice is given that the undermentioned patents were endorsed "Licences of Right" on the dates shown:—

June 9th, 1921.—No. 10898/14 (Van Der Hoorn, L. J.), "Improvements in or relating to electric sale apparatus."

June 10th, 1921.—No. 26187/10 (M. Brealauer), "Improvements in electric current generators." No. 28595/12 (R. Krause), "Improvements in appliances for producing electric oscillations." No. 13129/15 (W. Otto), "Arrangement for producing short unidirected high-tension electric current impulses." No. 11821 (12973/18) (E. Walter), "Improvements in braiding machines." No. 125369 (7217/19) (E. Walter), "Improvements in or relating to braiding machines."

Inquiry.—Makers of or agents for the "Ackermann-Johnson Anchors" for switchboards, are asked for.

Derby Agricultural Show.—At the above show, which is being held from June 28th to July 2nd, the advantages of electricity in farming will again be demonstrated. Messrs. Petters, Ltd., of Yeovil, intend to exhibit a number of examples of their engines and electric lighting and power sets. Among these will be a number of "Petter-Light" sets of various outputs with battery equipments, switchboards, &c.

E.D.A. Activities.—The British Electrical Development Association, Hampden House, 84, Kingsway, W.C. 2, is endeavouring to interest electrical contractors and suppliers of electricity in the use of local newspapers for the furtherance of the electricity campaign. To this end the Association has recently issued a book on the subject (E.D.A. No. 164), which suggests methods and matter to those concerned with local Press advertising. A number of suitable advertisements are reproduced in which are embodied the special points brought out in the text. These advertisements are all illustrated, as the best way of appealing to the public is to please the eye, and the Association is prepared to supply "electros" of these pictures at reasonable prices. Accompanying the book is a sheet of seven advertisements which can be sent to a local newspaper as "copy" for reproduction.

The Director of the Association desires to state that information and inquiries may, in future, be sent under the same cover as circulars. Engineers and managers and others are requested to open and *examine* carefully all sample parcels of publicity matter and other communications from E.D.A. as received.

The Lyons Fair.—The Department of Overseas Trade is informed that, in connection with the Autumn Lyons Fair, an international competition for inventions will be held from October 1st to 15th, in the Palais de la Foire. All apparatus, plans, designs, or models, relating to the following will be eligible for competition:—(*a*) Electric accumulators and electric apparatus; (*b*) textile machines and apparatus; (*c*) automobile and cycle improvements; (*d*) agricultural machines; (*e*) artificial limbs; (*f*) domestic heating; (*g*) apparatus for protection of workers. An entrance fee of 50 fr. will be charged for each invention entered. Applications should be sent in before September 15th to the Société des Inventeurs, 17, Place Bellecour, Lyons.—*Board of Trade Journal.*

Withdrawal from Whitley Council.—The St. Helens Electricity Committee's recommendation to the Town Council to withdraw from the District Council No. 3 (North-Western Area) for the Electricity Supply Industry, has been accepted. The ground upon which this decision was reached was that the Electricity Committee did not think that the Whitley Council was the best method of considering the wages to be paid to its men.

Book Notices.—Circular No. 100 of the U.S. Bureau of Standards, "Nickel" (106 pp.). Washington: Government Printing Office. Price 20 cents.—This is a very comprehensive treatise upon nickel and its alloys. Dealing first with sources and the metallurgy of the subject, it passes to the chemical and physical properties of nickel, dealing exhaustively with its conductivity, magnetic properties, density and other characteristics. The technologic section includes such processes as casting, rolling, forging, welding and electro-deposition. Among the alloys of nickel treated upon in this circular are monel metal, copper-nickel, ferro-nickel (nickel steels), and special acid resisting and electrical alloys. The appendices give definitions of physical terms, U.S. patents on nickel alloys (1900-1920), typical specifications and a bibliography.

"Modern Central Stations." By C. W. Marshall. Pp. x + 112, 25 figs. London: Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XL, No. 6, June, 1921. New York: The Institute. $1.

Technologic Paper, No. 188, of the U.S. Bureau of Standards. "Some Properties of White Metal Bearing Alloys at Elevated Temperatures." (16 pp.) Washington: Government Printing Office. Price 5 cents.—This paper describes an apparatus for determining the yield-point and ultimate strength of white metal bearing alloys at temperatures up to 100° C. An apparatus for ascertaining the Brinell hardness of these alloys is also dealt with.

"Pitman's Technical Bookshelf." No. 4, June, 1921. (20 pp.) London: Sir Isaac Pitman & Sons, Ltd.—Many interesting notes and short reviews of books dealing with all branches of technical work are included in this issue, and electrical engineering and its auxiliary subjects receive a great deal of attention.

"The Cost Accountant." Vol. I, No. 1, June, 1921. London: The Institute of Cost and Works Accountants.—This is the first appearance of the recently-formed Institute's official journal which is to be published monthly. Many useful notes appear, as well as articles on accountancy, progress work, and costing.

"Electric Motor Installations: Their Upkeep and Lay-out." (The Vulcan Engineering Manuals.) (112 pp.). Manchester: Vulcan Boiler and General Insurance Co., Ltd. Price 2s. 6d. net.

"The Metropolitan-Vickers Gazette." Vol. VI, No. 98. May, 1921. Articles included in this number of the "Gazette" are "Installation and Operation of M-V Power Transformers," by A. J. Bridge; "Heating and Cooling Curves and their Application to Oil Circuit Breakers," by G. E. Gittens, B.Sc.(Lond.); "Electrical Equipment for Arc Welding"; and two reprinted papers on "The New Management" and "Radiology Applied to the Testing of Materials."

"The Mining Electrical Engineer." Vol. I, No. 9. June, 1921. Manchester: The Association of Mining Electrical Engineers. Price 1s. net. The final number of the first volume contains papers on "Electric Winding," by A. B. Maclean, M.A., B.Sc.; "The Power Requirements of Collieries," by J. M. Heslop; "Oil Fuel for Steam Raising," by H. T. Watson; and an illustrated description of a large underground plant.

Science Abstracts. Sections A and B. Vol. XXIV, Part 5. London: E. and F. N. Spon, Ltd. Price 2s. 6d. net per part.

"*Engineering* Directory." No. 68. May, 1921. (120 pp.) London: *Engineering*, Ltd.—This is the latest edition of the alphabetical and classified list of advertisers in our contemporary, and it possesses the usual features of utility, including glossaries for the use of foreign buyers.

"The *Journal* of the Röntgen Society." Vol. XVII, No. 67. April, 1921. (48 pp.) London: Percy Lund, Humphries & Co., Ltd. Price 5s. net (quarterly).—In this issue is described a new type of X-ray photographic plate, which reduces the time of exposure necessary to one twenty-fifth of the normal. Mr. N. A. Codd's paper on "Increasing the Efficiency of X-ray Tubes by an Improved Design of Coil and Interrupter" is reprinted, as is also a lecture by Mr. N. E. Luboshez on "Scattered Radiation and the Use of Intensifying Screens."

"Rate Research." Vol. XIX, No. 9. (14 pp.) New York: National Electric Light Association (Rate Research Department). This issue deals with the papers recently read before the Institution of Electrical Engineers by Messrs. Beauchamp and Blaikie, as well as a number of decisions regarding tariffs in the United States.

"Coal Mines Act: Statutory Rules and Orders, 1921." No. 672. (10 pp. and 5 plates.). London: H.M. Stationery Office. Price 6d. net.—This publication describes and illustrates a number of miners' safety lamps which conform to the "Safety Lamps Order" of April 20th, 1921.

"Useful Tables and Data for the Assistance of Consumers of Wire." Third Edition. London: W. F. Dennis & Co., 70, Queen Victoria Street. Price 2s. 6d. (leather, 3s. 6d.).—This is a handy vest-pocket booklet containing a great amount of information regarding aluminium, steel, iron, copper, bronze, and other wire. Physical and electrical characteristics are fully dealt with, such details as breaking-strain for various sizes, conductivity, weights, &c., being given in table form.

Strike at Birkenhead.—A correspondent states that the electricians at Messrs. Cammell, Laird & Co.'s shipbuilding works, Birkenhead, are on strike owing to the non-reinstatement of the apprentices who participated in the recent electrical trades dispute. The firm contends that the apprentices broke their indentures, and they are not obliged, therefore, to re-employ them. The journeymen members of the Electrical Trades Union have now been on strike nearly five weeks, but there is stated to be a prospect of an early settlement.

Copper and Lead Prices.—MESSRS. F. SMITH & Co. report June 21st. Copper (electrolytic) bars, sheets, wire rods, and h.c. wire. No change.

MESSRS. JAMES & SHAKESPEARE report June 22nd. Copper bars (best selected), sheet and rod, £114, £2 decrease; English pig-lead, £23, 5s. reduction on last week's quotation.

Annual Outing.—The annual outing of the staff and employés of Messrs. Semco, Ltd., took place on Saturday, June 11th. The party went by char-à-bancs from the company's head offices in High Street, Shoreditch, to Egham-on-Thames, the route chosen being *via* Kingston and Hampton Court. Luncheon was served at the Coach and Horses at Egham, and sports followed. There was a cricket match between the Inside and Outside staffs, in which the latter won. Time was then pleasurably occupied on or beside the river. Tea was served later, and during the sitting thanks were accorded to Mr. J. H. Smith, the secretary of the company, who had carried through the day's arrangements. The party returned to town *via* an extended route through Virginia Water and Windsor.

The Bristol, Cardiff, and Swansea staff of the Edison Swan Electric Co., Ltd., held their annual outing on 8th inst., when the Wye Valley was visited by motor-coach. The company numbered about 70. After various sports had been indulged in, tea was served at the Royal George Hotel, an impromptu concert following.

The Engineering Wages Dispute.—The revised terms submitted by the Engineering and the National Employers' Federations to the Trade Unions concerned, for a decision by ballot, are as follows:—With respect to the bonuses of 7½ and 12½ per cent., one-third of these will be withdrawn at the commencement of the first full-pay period in July, one-third in August, and the remainder in September. At the commencement of the first full-pay period in October next, 3s. per week will be deducted from time rates and 7½ per cent. from piecework rates. A further 3s. per week will be deducted from the war bonus of 26s. 6d. when the Ministry of Labour index number arrives at 115 per cent. over the pre-war level; this last reduction is not to be made earlier than the beginning of the first full-pay period in November.

Fusion of Interests in Germany.—The *Kolnische Zeitung* reports a fusion of interests of six railway, tramway, and other carriage-manufacturing companies. The new company is registered in Dusseldorf, and comprises Dessauer Wagonfabrik A.G., Dessau; Dusseldorfer Eisenbahnbedarf vorm. Karl Weyer & Co., Dusseldorf; H. Fuchs, Wagonfabrik A.G., Heidelberg; Siegener Eisenbahnbedarf A.G. Siegen; Wagonfabrik A.G., Uerdingen a/Rh; Wegmann & Co., Cassel.

Works Boys' Club.—Recent extension of welfare work at the Phœnix Dynamo Manufacturing Co., Ltd. (branch of the English Electric Co., Ltd.), Thornbury, Bradford, includes a commodious club for the boy employés, comprising a full-sized Army hut, adjoining the works tennis courts. The opening ceremony was performed last week by Captain Crawshaw, works manager. The club includes a canteen, billiard room, and cold douche. Provision is made for many other games, and the club is fully lighted by electricity. The main hall has a platform with scenic background. At the opening there was a concert by the works orchestra and artistes specially engaged, followed by dancing. A girls' club will shortly follow.

For Sale.—Assets Auctions Co., Ltd., will sell by auction, on June 29th, at 119-121, Newington Causeway, Government surplus telephone and electrical stores. Ormskirk Board of Guardians has for disposal one 50-b.h.p. "National" gas engine, coupled to a "Witton" multipolar 220-v. d.c. dynamo. For particulars see our advertisement pages to-day.

Should Corporation Electrical Engineers Accept Contracts?—This question was raised at the last meeting of Kilmarnock Town Council. The electrical engineer reported that "he had placed the steel work on order, which included columns, roofing, roof trusses, and corrugated iron required for the extension of the car-shed; that Redpath, Brown & Co. quoted £549 for this work, and that being the lowest offer, he had placed the order with them." A member asked whether the Electricity Committee had given the manager power to accept contracts, and objected to any official being allowed to do so. The Provost pointed out that the Committee approved of the engineer's action, but it was agreed that the Electricity Committee alone be given power to settle contracts.

Swedish Telephone Companies.—The plan to fuse the H. T. Cedergren and L. M. Ericsson telephone concerns, proposed by the boards of the companies concerned, was defeated at a general meeting of the Cedergren Co. by a large majority.—*Reuter's Trade Service* (Stockholm).

Germany and the Metal Trade.—It is reported from New York that active steps are being taken by Germany to regain her pre-war ascendancy in the non-ferrous metal markets of the world. S. S. Tuthill, Secretary of the American Zinc Institute, says that the American trade is threatened, and that at present Germany and Belgium are negotiating for a re-establishment of their former trade relations with the metal markets.

LIGHTING AND POWER NOTES.

Accrington.—Proposed Price Increase.—The Town Council, as the outcome of the loss of £13,000 on the electricity undertaking last year, is proposing to increase charges for lighting from 7d., plus 10 per cent. per unit, to 8d. per unit, and to increase the charges for power on a sliding scale. Power users who have paid 1½d. per unit will have to pay, roughly, 1¾d. The new charges are expected to bring in an extra revenue of £15,000 a year, and they will come into operation next month.

Australia.—Subiaco (W.A.).—The Municipal Council has been unable to meet the demand for electricity, owing to the limited capacity of its plant. At the last meeting of the Council it was decided to raise a loan of £25,000 in order to arrange for a complete change over. The existing plant is totally inadequate, and negotiations have been opened up with the Perth City Council to supply electricity in bulk at low pressure. This will necessitate an alteration of existing arrangements.—*Tenders.*

Sydney (N.S.W.).—The North Sydney Council has asked the Sydney City Council to consider the question of a bulk supply in place of supplies to individuals in the North Sydney district. Reporting upon the matter, Mr. Forbes Mackay, the electrical engineer, thinks that a bulk supply would probably be more remunerative to the City Council than the existing arrangement.

The Morwell Scheme.—A large body of opinion in the country districts of Victoria holds that the Government did not properly investigate the possibilities of generating electrical energy by water power before embarking upon the scheme for generating energy from brown coal at Morwell. Having committed itself to the Morwell scheme, the Government, it is alleged, is placing needless and fatal restrictions upon private enterprise in the development of hydro-electric schemes. The principal desire at the moment is that these restrictions should be removed, so that all schemes that are capable of commercial success may have an equal opportunity of development.

At the instance of the Victorian Farmers' Union, a conference on the subject was held at the rooms of the Employers' Federation in April. The delegates represented a great variety of country interests, including branches of the V.F.U., municipalities, butter factories, irrigation settlements, and country industries generally. Some of the metropolitan municipalities were also represented. The following motion was carried unanimously:—

"That the Government be requested to proceed with the Morwell and Kiewa electrical schemes concurrently, or to withdraw opposition to the Kiewa scheme by private enterprise, and to withdraw all restrictions to the Kiewa company entering into competition with the State enterprise."

In a reply to these criticisms, Sir John Monash said the Morwell scheme had been undertaken under the best possible advice. The commission's engineering staff had a very high standing, and Mr. Merz, of Merz & M'Lellan, had investigated all the proposals for the generation of power, and had recommended the Morwell scheme. Mr. Merz having endorsed this view, the Government submitted the scheme to Parliament. Hydro-electric possibilities had been investigated by Mr. A. G. M. Mitchell, the most prominent hydraulic engineer in Australia. His report on the Kiewa scheme showed without doubt that any development in this direction would be premature, and was not to be preferred to the Morwell scheme.—*The Age* (Melbourne).

The Metropolitan-Vickers Contract.—In view of the importance and magnitude of the Morwell scheme, it may be of interest to note a few details relating to the power-station generating plant, the contract for which has been secured by the Metropolitan-Vickers Electrical Co., Ltd.

Five main generating units and one auxiliary unit have been ordered, the aggregate capacity of the plant being 63,100 kW. Each of the main units will have a maximum continuous rating of 12,500 kW, and will run at a speed of 3,000 r.p.m. The auxiliary emergency set will have a maximum continuous rating of 600 kW at 3,000 r.p.m. Steam will be raised in boilers fired with brown coal, having a calorific value of about 6,000 B.th.u. per lb., and will be supplied to the turbines at a normal pressure of 250 lb. per sq. in. gauge and a normal temperature of 630° F. The main turbines will be of the multiple-exhaust type, and will be equipped with self-contained feed-heating systems, the heaters being arranged within the turbine casings, in accordance with the Metropolitan-Vickers standard arrangement, in which the steam used for heating is diverted from the turbine at a pressure of about 5 lb. per sq. in. absolute. The turbines will exhaust into surface condensers, to be made in Australia. Each condenser will have a cooling surface of 17,000 sq. ft., and will be designed to maintain a vacuum of 28 in. at full load when supplied with cooling water at a temperature of 70° F. The condenser auxiliaries will consist of motor-driven vertical centrifugal circulating-water pumps, motor-driven condensate extraction and lift pumps, and steam-operated air ejectors.

Each of the main alternators will be wound for three-phase, 50 periods, 11,000 volts, the specified capacity being obtained at '9 power factor. The alternators will be ventilated on the closed air-circuit system.

The 600-kW auxiliary turbo-alternator set will be required for starting up the station auxiliaries and for emergency purposes only. The turbine of this unit will be of the back-pressure type, designed to exhaust against a normal pressure of about 1 lb. per sq.-in. gauge. The alternator of the auxiliary set will be wound for three-phase, 50 periods, 400 volts, '8 power factor.

Aylesbury.—Loan.—The Town Council has applied for a loan of £4,500 for services.

Bedwas.—Bulk Supply.—At a meeting of the District Council a report was submitted by the Lighting Committee recommending the Council to exercise the powers to be conferred by the Electricity Commissioners, and that negotiations be opened up with the South Wales Power Co. and the Bedwas Navigation Colliery Co. for a supply of electricity in bulk and specifications prepared for tenders for the installation of electric lighting in the Bedwas and Machen wards. The clerk said it was proposed only to apply the order to Bedwas and Machen at present, but it would be extended to Trethomas and Maesycwmmer later. It was also intended to install electric lighting in the Council's new houses on the Glebe site, Bedwas.

Belfast.—Loan.—Mr. A. D. Price, Engineering Inspector of the Local Government Board for Ireland, held an inquiry, on June 15th, into the application made by the Corporation for sanction to a loan of £120,000 for the electricity undertaking. The Town Solicitor gave evidence as to the finances of the city, and the need for the loan to meet business requirements, &c. More than the £120,000 required was owed the Corporation, but it took a long time to get it in, and although the Corporation sought an overdraft, it did not follow that interest would have to be paid on that sum. The interest would rise and fall with the income derived from the electrical undertaking. Coal was badly needed, and large stocks absolutely essential. But for the foresight of those responsible for the stock of coal, it was quite possible that the electrical and gas undertakings would have been closed down long ago. Mr. R. G. Geale, city accountant, gave evidence, as did also Mr. T. W. Bloxam, the electrical engineer, and the inquiry closed.

Bexhill.—Year's Working.—The accounts of the Corporation electricity undertaking for the year ended March 31st, 1921, show gross profits of £7,460, an increase of £1,060 on the previous 12 months. After making provision for repayment of loans and income-tax, there is a net profit on the year's working of £639. After writing off a debit balance of £122 on the previous year, a credit of £517 is carried forward.

In view of the appeals for economy in use of electrical energy owing to the coal situation, the Council has decided to abandon the minimum charge for the current half-year.

Berkhamsted.—Overhead Lines.—The Urban District Council has objected to the erection of overhead lines by the Chesham Electric Light and Power Co., Ltd., for the supply of electricity in the parish of Northchurch, on the ground that the poles would be an obstruction and dangerous to the public.

Blackburn.—New Sub-station.—The chairman and vice-chairman of the Electricity Committee have been empowered to acquire a plot of land at Lower Darwen for the erection of an electricity sub-station.

Bolton.—Year's Working.—The accounts of the Corporation electricity department for the year ended March 31st last, record a total income from all sources of £273,531, as compared with £200,569 in the previous year. Working expenses totalled £186,350, as against £140,248, leaving a gross profit of £87,181 (£60,321). After payment of capital charges, &c., the result was a net profit of £27,779, comparing favourably with a balance of £19,965 for 1919-20. Of this profit, £24,130 was allotted to expenditure out of revenue, and the balance carried forward. The borough electrical engineer (Mr. W. J. H. Wood) points out that although, on account of increased fuel costs, the cost of generation has increased considerably, this cost is still below 1d. per unit, and at present-day prices the average selling price of 1·55d. per unit is not unreasonable. The number of units sold rose from 24,944,906 to 30,298,980.

Bootle.—Extension of Supply.—The Electric Power and Lighting Committee has resolved to take the necessary steps to obtain the consent of the Electricity Commissioners to the extension of a supply of electricity to the Litherland area, and that the Litherland Council be informed that the Committee suggests that the Council should furnish a guarantee of consumption at a certain figure. The Bootle Council entered into an agreement with the Litherland Council in 1914 to take over the Lighting Order which was to operate until six months after the official termination of the war. The Electric Power and Lighting Committee had a number of demands from Litherland, but in each case it had to get a further order from the Electricity Commissioners. When it was moved in the Bootle Council Chamber that application for a special order be made to the Electricity Commissioners, it was pointed out that one of the firms concerned was so anxious to get a supply that it was willing to lend the Council £3,000.

Bradford.—Lighting Economy.—The Corporation has set up a Special Joint Sub-Committee to inquire into, and report to the Corporation upon, the practicability of suspending street lighting for the three summer months of June, July, and August every year, as a measure of public economy, quite apart from the present question of coal shortage.

Canada.—New Ontario Loan.—A loan of about $22,000,000 (nominally £4,400,000) is expected to be floated for the Province of Ontario in about two or three weeks, according to an announcement made by Mr. Peter Smith, Provincial Treasurer. Mr. Smith indicated that it might be necessary to go to New York to secure at least a part of the loan. The bulk of the funds to be secured will be used for the Hydro-electric Power Commission's purposes.—*Reuter.*

QUEENSTON-CHIPPAWA CANAL.—About 7,000 men are at work on the Queenston-Chippawa Canal development for the Ontario Hydro-Electric Power Commission. It is expected that by the beginning of September two 55,000-h.p. generators will be ready for operation. The Commission's plans call for another 55,000 h.p. a few months later, and the ultimate production calculated upon is over half a million h.p. selling at a probable price of $10 per h.p. —*Reuter's Trade Service* (Ottawa).

DEVELOPMENT OF THE ST. LAWRENCE RIVER.—In an elaborate report, made to the International Joint Commission (Canada and the United States) on the deepening of the St. Lawrence for ocean-going vessels, and the development of the power possibilities, the engineering firm of Messrs. Hugh Cooper and Co., of New York, proposes to finance, on behalf of private capitalists, 1,000,000 h.p., and to construct a 30-ft. navigation channel, says the *Montreal Gazette*. The cost of the canalisation would not be more than $30,000,000 each to the Governments of Canada and the United States. The power will cost consumers, exclusive of State and Federal taxes, about $17 per h.p. The first installation, it is proposed, will be on the American side, and will supply 400,000 h.p., 50,000 of which will be available for distribution in Canada, and when the demand exceeds this quantity construction on a Canadian site will commence. The ultimate electrical power that can be produced is stated to be 6,625,000 h.p. This would replace 66,250,000 tons of coal annually, and, by the improvement of the canal system, the present 46 miles of canal and 21 locks can be replaced by 3½ miles of canal and six locks. The cost of this improvement in navigation, and the power development, is estimated at $1,500,000,000.—*Reuter's Trade Service* (Ottawa).

ELECTRICAL SMELTING IN VANCOUVER.—The managing director of the Canadian Iron and Steel Smelters, Ltd., has announced that British capital has been secured to build and operate a large electric smelter in Vancouver. An initial 50-ton plant will be operating by August. The company has been given 5,000 tons of iron ore by the Provincial Government as an inducement to commence operations.—*Reuter's Trade Service* (Vancouver).

Carlisle.—REPORT ON UNDERTAKING.—The town clerk has been requested to ascertain the terms upon which Mr. Arthur Ellis, of Cardiff, the consulting engineer nominated by the President of the Institution of Electrical Engineers, will undertake to report upon the present position of the electricity undertaking, with his recommendations for meeting the future demands upon the undertaking.—*Carlisle Journal.*

Chesham.—CHEAP LIGHTING.—The Electric Light Co. has offered to supply electric light to the new Council houses at 1s. per week during winter months, and 6d. per week during summer months. Householders are not to be limited to a particular amount.

Continental.—SWEDEN.—The increased use of electricity in Sweden is shown by the following official figures relating to the years 1917—1919:—Number of electricity works in 1917, 1,760; in 1918, 1,887; in 1919, 2,057. The total power of the generating plant in the three periods was, respectively, 1,028,758 kW, 1,270,227 kW, and 1,238,215 kW. The power furnished to motors in the three years was 343,273 kW, 362,258 kW, and 410,767 kW. The power supplied to electro-chemical factories was 478,763 kW, 568,386 kW, and 502,833 kW. The number of glow and arc lamps installed was of the former:—3,704,374 in 1917, 3,027,518 in 1918, and 3,610,102 in 1919; of the latter in the same periods: 2,815, 2,152 and 610, showing a steady fall off in their use. The number of motors installed in the three periods was 34,963 in 1917, 29,838 in 1918, and 34,749 in 1919.—*L'Industrie Electrique.*

RUSSIA.—During the year 1920, says a Russian journal, electricity was furnished to Moscow from several stations; namely, the Moscow Government electrical station, the Moscow tramway system station, the Elektroperedatchas, the Gluchovskaya Stantzia, and the Orechov-Zubskaya group. The Moscow Government electrical station was itself of sufficient capacity to supply all the demands of the town, but owing to the scarcity of fuel, the work had to be done by less powerful stations with their available fuel. The estimated requirements of Moscow for 1920 amounted to 80,000,000 kWh. The quantity supplied was 72,000,000 kWh., *i.e.*, 90 per cent. The demand for electricity increased in the later months of 1920. Of the total quantity delivered in Moscow, 44 per cent. was for power purposes, and 56 per cent. for lighting. There was an increase under both heads over 1919.

The *Novy Put*, referring to the Russian electrical services, says that the leading combination, called the "Elektrosila" (electric power) section, includes 10 factories, of which the most successful are the Siemens-Schuckert, the Dynamo, and V.E.K. The reports on the others are not particularly satisfactory.

The same journal refers to a direct electric train service on the "Machovin" system, to be started soon between Petrograd and Moscow.

GERMANY.—An amalgamation of the electricity supply works owned by the State, and carried on under joint stock auspices, either in continuation of former company proprietorship, or as special companies created by the Government, has now been decided upon, the absorbing concern being the Electro-Works Co., of Berlin, which was formerly the Golpa-Jessnitz Lignite Co., of Bitterfeld, and which supplies power to, among others, local ammonia nitrate works, based upon the fixation of atmospheric nitrogen. The Electro-Works Co., for instance, is taking over the assets of the central German concerns known as the Power Transmission Co., the Central German Power Works Co., the Mioderlausitz Power Works Co., the Brigitta-Sachsenburg Corporation, and the Lignite Co., and thus secures possession of the power works at Zschornewitz, Trattendorf, near Sprenburg, and Lauta, the lignite mines of Golpa and Brigitta, and the high-pressure transmission lines from the power stations situated in the lignite districts of Bitterfeld and Lausitz to Berlin and to Saxony. These cases, however, are not the only instances of companies whose shares are entirely held by the State, as most of the former State armament works are now vested in a Government company, under the title of the German Works Co., and are apparently engaged on peace-time manufacturing work.

FINLAND.—The Finnish Government has just asked the Chamber of Representatives for a loan of 22,500,000 fr. for the first portion of the work of developing the State waterfalls. Finland possesses very considerable water-power resources, only a small fraction of which is at present utilised. It is reckoned that the falls on the river Ulea, and on the watercourses more towards the south, are equal to 1,600,000 h.p. at the turbines. A large part of these belong to the State, which owns the most important, or, at least, is interested in their utilisation. On the upper Vuoksen it has the disposition of 380,000 h.p. as possessor of the Imatra Falls, and is the principal shareholder in the undertaking concerned with the development of the Tornator Falls (211,000 h.p.), the Kymmense River (18,500 h.p.), the river Ulea (542,000 h.p.), and the Pyakos Falls (99,800 h.p.). Although the outlay on the utilisation of these several falls will amount to many hundred millions (it is reckoned that the falls of Imatra alone will call for 320,000,000 fr.), it is, nevertheless, held that the Government should not hold its hand, for the high price of both coal and wood has forced a large number of industrial undertakings to utilise the falls belonging to them, which are, however, not being worked under the most favourable conditions.—*L'Industrie Electrique.*

Derby.—FIRE AT POWER STATION.—An outbreak of fire occurred at the Derby electricity works on June 11th, causing a dislocation of the tramway services. As the fire happened somewhere about the factories' closing time, they were not affected to a great extent. This is the second recent fire; the first occurred on May 13th.

Douglas (I. of M.).—ELECTRICITY COMMITTEE.—At the June meeting of the Town Council a resolution was moved: "That as the purposes for which the Electric Lighting Committee was established have now been accomplished, it is necessary that a standing Electric Lighting and Power Committee be appointed from the Council to deal with the electrical undertaking, and to carry out the terms and conditions of the Bill which has now passed both branches of the Legislature, and under which certain work must be commenced within six months of the date of its promulgation." After a lengthy discussion the motion was defeated, the town clerk explaining that it was for the Council to give the existing Committee a fresh appointment, or else appoint a Standing Committee.

Hamilton.—PROPOSED WATER-POWER SCHEME.—It was reported to the Town Council that a company is considering utilising certain water power in Lanarkshire for the generating of electricity. The matter has been remitted to Messrs. Edmundsons for their consideration. The Council is applying for power to borrow £12,000 for extensions.

Inverness.—PROPOSED WATER-POWER SCHEME.—At a meeting of the Town Council on June 13th, the Council's consulting engineers presented a report on a scheme for providing electricity to the town by means of water power. It is proposed to utilise Loch Luichart for this purpose, and the districts included in the scheme are Strathpeffer, Dingwall and Inverness. The estimated capital expenditure will be £230,000, and an output of 8,800,000 kWh is expected to be obtained. Later the supply may be extended to Invergordon, Tain, Elgin and Lossiemouth. It was stated that the price per kWh could be fixed at 3d. for Inverness and 1d. for Strathpeffer and Dingwall.

Leeds.—YEAR'S WORKING.—The report upon the electricity works for the year ended March 31st, 1921, records a total income from all sources of £519,021, as compared with £468,718 during 1919-20. Working expenses amounted to £313,055, as against £237,823, leaving a gross surplus of £205,966 (£230,895). Income-tax and loan charges absorbed £152,105, leaving a net profit of £53,861, little more than half that of the previous year (£100,418). Of this profit, £23,592 was contributed to capital expenditure, leaving an actual surplus of £30,269. The total number of units sold rose from 63,023,502 to 63,921,813, and the generating costs per unit sold from 1·41d. to 1·71d. The average price obtained per unit increased to 1·95d. from 1·79d. The electrical engineer reports a relatively large increase in the amount of energy used for heating purposes, but the demand for power for traction purposes fell off. The generating capacity remains at 51,000 kW.

London.—WOOLWICH.—The Borough Council has decided to apply for permission to raise its statutory maximum charge for electricity for lighting from 6d. to 10d. per unit.

ST. PANCRAS.—The Council has received the permission of the Electricity Commissioners to borrow £26,450 for the provision of generating plant, and £12,700 for the purchase of converting plant.

Long Eaton.—YEAR'S WORKING.—It is reported that the working of the Council's electricity supply undertaking, for the year ended March 31st last, resulted in a deficit of £3,200.

Middlesbrough.—Temporary Price Increase.—The Cleveland and Durham County Electric Power Co. has asked the Middlesbrough Corporation to agree to an additional charge of ¼d. per unit on a proportion of the units supplied, to cover the cost of oil firing during the present coal shortage. This has been agreed to, and the charge will be increased to consumers by a corresponding amount on the expiration of the present quarter.

New Zealand.—Thames Valley.—Paeroa is the first town in New Zealand to obtain electric light through the operation of the Electric Power Boards Act of 1918. The power is derived from Horahora, the controlling body being the Thames Valley Electric Power Board. This Board was gazetted in February, 1920, and, as a preliminary, it was decided to obtain power to borrow £200,000 for reticulating the district. The consulting engineers to the Board realised that the cost of reticulation would greatly exceed this sum. They considered it might be in the neighbourhood of £500,000, but they were not prepared to give definite figures until a thorough investigation of the district had been carried out. This investigation has now been made, and the engineers estimate the total cost of the scheme at £514,000, exclusive of interest during construction. They consider the work can be completed in from five to six years. The annual revenue is estimated at £93,000, and total annual expenditure at £88,000. These figures are based on a canvass of the district carried out in April and May, 1920. The maximum demand will be in the neighbourhood of 3,000 kW.—*Auckland Weekly News.*

Progress of Works.—The *Auckland Weekly News* says that the Lake Coleridge station, which supplies Christchurch and Canterbury, is being extended as rapidly as possible by the diversion of additional water and an increase of plant. It is hoped shortly to be able to meet the demand, and also to supply the power demanded by South Canterbury. To supply Dunedin 8,000 h.p. is being developed at Waipori, and arrangements have been made to double this output. It has been considered inadvisable to proceed with works on Lake Hawea and Wanaka for the present. Another Southland project is the development of power at Monowai; owing to financial stringency the Government has had to assist this scheme with a guarantee.

Oldham.—Inferior Coal.—For the past fortnight the cost of coal per unit sold by the Corporation electricity works has been 1·77d., as compared with 0·70d. for the corresponding period of last year, the difference being largely due to the very poor quality of coal now being supplied.

Preston.—Purchase of Undertaking.—During the hearing, in London, of an application by the National Electric Supply Co., Ltd., for sanction to a scheme of distributing profits and assets between the various classes of shareholders, in consequence of the sale of the Preston undertaking to the Corporation, it was stated that the price of purchase was £266,000, £61,000 of which would be paid in cash and £205,000 in mortgage bonds secured on the rates.

Rathmines (Dublin).—Strike Ended.—The electricity supply service has been resumed, on the settlement of the municipal employés' five weeks' strike on a wage issue.

Shanghai.—Year's Working.—The annual report of the engineer-in-chief and manager of the municipal electricity department for the year ended December 31st, 1920, has just come to hand. It is interesting to recall the fact that the lay-out and design of the power and sub-stations, distribution system, and in fact everything connected with the undertaking, is planned in the department's offices at Shanghai, and that the selection of tenders by the Electricity Committee is made solely upon the recommendation of Mr. T. H. U. Aldridge, M.I.E.E., &c.; the European staff numbers 105, and the Chinese 2,207. Financially, the year's business has resulted, after providing for interest (Tls. 464,306), and depreciation (Tls. 575,816), in a net profit of Tls. 781,916, which will be appropriated as follows:—Contribution to the municipal general funds, Tls. 630,000; transfer to general reserve, Tls. 72,800; transfer to contribution to general funds (equalisation account), Tls. 78,200, the balance (Tls. 916) being carried forward. The gross profit on the revenue account is Tls. 1,290,121, which represents 10·34 per cent. on the undertaking's capital outlay, and the estimated net profit for 1921 is Tls. 1,029,816. It is regrettable that after having taken steps to procure additional generating plant to meet the increasing demand, the delayed delivery by many months of the 42-in. circulating water-pipes should have prevented the use of the first of the two new 18,000-kW turbines. The operative plant capacity of the generating stations on December 31st, 1920, was the same as at the end of 1919, viz., Riverside station, 33,000 kW, and Fearon Road station 5,600 kW. A 10,000-kW turbo-generator, built by Messrs. C. A. Parsons & Co., was put into service in April in the Riverside station, and would normally have increased the plant capacity, but in March the No. 3 5,000-kW A.E.G. machine broke down, and the other machine (No. 4) of the same make and size failed in April. The first was repaired and in service again in July, but broke down a second time in September; both sets being then unfit for further service were scrapped. The loss of these two machines prevented the long-overdue overhaul of the G.E. Co. 10,000-kW set (No. 5), which during 1920 ran practically continuously every day throughout the year. First put into commission in September, 1917, it was out of service for only 34 days up to the end of October, 1919. Adverse conditions frustrated the hopes of materially reducing the cost of production during the year, and made it necessary to restrict the output to new consumers by some 4,000 kW. A testing department has been started at the power station under the direction of a fully qualified analytical chemist, and the plant additions, which will be available for use in 1921, consist of two 18,000-kW turbo-generators, with condensers already installed, and one 10,000-kW machine, all built by the G.E. Co. Two Babcock & Wilcox, and two Stirling 80,000-lb. boilers, with mechanical stokers, were ordered in 1919, but the delivery promises were not fulfilled. The maximum load was 36,742 kW, and the load factor improved to 46·7 per cent. The total kWh generated amounted to 179,619,458, and those sold to 144,539,632, an increase of 41·2 per cent., made up as follows:—Private lighting, 20,298,672, an increase of 23·93 per cent.; public lighting, 1,454,812, an increase of 21·9 per cent.; heating and cooking, 1,240,136, an increase of 30 per cent.; power, 116,839,147, an increase of 46·71 per cent.; and traction, 4,706,865, an increase of 12·3 per cent. The ability of the department to meet unprecedented demands for power has been seriously in question upon several occasions during the year, owing to non-delivery of plant long overdue. Recent contracts placed in Great Britain amount to £504,026, and in the U.S.A. to 676,792 gold dollars.

Southampton.—Supply to Itchen.—In a report to the Town Council upon the question of supplying electricity to Itchen, the electrical engineer states that it will be necessary to dredge a trench across the river in which the cables will be laid, the trench afterwards being filled in naturally by the silt. The estimated cost of the supply is £25,000, and it is recommended that the scheme be proceeded with as soon as a sufficient number of residents in Itchen signify their desire to take a supply.

Swansea.—Closing of Dock.—The Swansea Harbour Trustees have written to the Corporation intimating that unless the Corporation contributes to the establishment and other charges incurred by the North Dock, this dock will be closed, as the reduced state of the traffic dealt with does not justify its being kept open. The Corporation derives its water for condensing purposes from this dock, but the Electricity Committee points out that as much water is returned as is taken out, and it costs the Trustees nothing. The Trustees' request is therefore considered preposterous.

Wallasey.—Breakdowns.—Last week there were three more electricity failures at Wallasey, resulting in the stoppage of the electric tramway service, once on Wednesday and twice on Thursday. The explanations given for the stoppages are—a faulty boiler tube, shortage of oil, and the poor quality of the fuel.

Wolverhampton.—Alterations, &c.—The Electricity Committee has authorised the electrical engineer to carry out by direct labour certain alterations to the building in Commercial Road, previously used as a store, in order to convert it into a sub-station to contain the seven large transformer units required to give a bulk supply to the Midland Electric Corporation, Ltd., and the Cannock Urban District Council, at an estimated cost of £487. In order to give a supply of electricity to the 225 houses to be erected at Parkfield Road, under the Housing Scheme for the Borough, and also to provide for the lighting of the streets in this district, authority was given for the laying of the necessary mains, &c., at an estimated cost of £3,203.

Worksop.—Electricity for Waterworks.—It has been decided to install electric motors in the place of the existing steam engines to drive the pumps at the waterworks.

TRAMWAY AND RAILWAY NOTES.

Barrow.—Loan.—Application is being made by the Town Council for sanction to borrow £16,000 for additional car accommodation, including the purchase of land, &c. New points and crossings are being purchased at a cost of £2,800.

Cardiff.—Proposed Fare Revision.—Owing to the losses incurred by the tramway undertaking, the City Council is considering the revision of fares at a special meeting.

Chadderton.—Application for Time Extension.—The Urban District Council has agreed to join in a memorial to the Ministry of Transport, asking for an extension of two years in the time for the proposed extension of the tramways to the Butler Green district.

Continental.—Belgium.—The Société Bruxelloise d'Electricité is in negotiation with the Belgian State Railway authorities with reference to the supply of the necessary power for the part of the Brussels-Antwerp Railway which is being electrified.

Spain.—A concession has been granted to the Sociedad-Anonima Tranvia Central de Asturias for an electric line from Oviedo to Posada de Llanesa, and an electric tramway system at Oviedo.—*Reuter's Trade Service* (Madrid).

Halifax.—Track Renewals Approved.—At the Town Council meeting, last week, it was reported that the Ministry of Transport had sanctioned the doubling of the tramway track between Holly Bank Road and Thornhill Road, and the meeting approved the action of the chairman and deputy chairman of the Committee in authorising the work to proceed day and night in order to provide work for the unemployed.

Hull.—Oil Fuel.—The general manager and engineer of the Corporation tramways gives some interesting information regarding the use of oil fuel in an article contributed to the

Tramway and Railway World. A sufficient number of boilers to take the whole of the tramway load was equipped with gravity-fed burners with oil jets, arranged in the centre of steam jets. The oil used is Mexican residual with a specific gravity of '987, and a calorific value of 18,750 B.th.u. per ton—the cost is £5 5s. per ton. A fortnight's working gave the following results, which are compared with the results from the use of coal. Oil fuel :—232 tons ; units generated, 238,865 ; lb. of fuel per unit generated, 2·17 ; cost of fuel per unit generated, 1·223d. For coal :—384 tons ; units generated, 238,865 ; lb. of fuel per unit generated, 3·6 ; total cost per unit generated (coal only), ·860d. The cost of converting four boilers was £300.

Jamaica.—RAILWAY ELECTRIFICATION DEFERRED.—The Kingston correspondent of *The Times Trade Supplement* states that the scheme for the electrification of the Jamaica Railway has been shelved owing to the question of cost. It would involve an expenditure of £2,000,000, and this, the Governor has informed the Legislature, is beyond the resources of the colony. The Council has sanctioned the further relaying of the Jamaica Railway, to enable surveys to be carried out in areas where the inhabitants are pressing for railway extension and bridge construction. The surveys will embrace at least four sections of the island.

Leeds.—YEAR'S WORKING.—The accounts of the Corporation tramway department for the year ended March 31st last show a total revenue from all sources of £995,636, as compared with £876,526 for 1919-20. Working expenses totalled £729,385, as against £606,347, leaving a gross profit of £266,251, a slight decrease on the previous year's figure—£270,179. After crediting bank interest, &c., and deducting loan interest and other capital charges, the result was a net profit of £5,580, a considerable fall from the profit of £83,757 realised in the previous year. This was occasioned chiefly by the heavy expenditure upon track renewals, which amounted to over £100,000. The number of car-miles run showed an increase of 2·98 per cent., being 10,176,874.

London.—AN UNDERGROUND STOPPAGE.—With the exception of the Central London Railway, the whole of London's underground railway services were held up on the evening of June 18th for half-an-hour. A shortage of steam occurred at 6.25 p.m. at the Lots Road power station, Chelsea, and this caused the power to fail. Many trains were stranded in the tunnels. By 6.55 p.m. the pressure was restored. The loss of pressure was understood to be due to the indifferent quality of the coal in use at the generating station. Ten of the 50 boilers generally working at Lots Road have been adapted to burn oil fuel, but these, it was reported, were not responsible for the delay.—*The Times.*

OIL FUEL AT GREENWICH.—It is stated that two boilers have been equipped for burning oil fuel, and that two others are in process of conversion at the L.C.C.'s Greenwich power station. The total estimated cost, including pipe-lines, is £4,200.

Sunderland.—NEW CARS.—The Corporation has purchased 12 saloon-deck and vestibule tramcars from the English Electric Co., Ltd., Preston. It is 14 years since the Tramways Committee bought any cars, so that these cars represent a considerable advance on anything that the town possesses. Two of the vehicles were put into service last week, and the remaining 10 will appear in a short time. These cars are fitted up with front exits, and a number of other cars are being arranged similarly, the authorities considering this a distinct advantage over the old types.

Westmorland.—PROPOSED MOUNTAIN RAILWAY.—The County Councils of Westmorland and Cumberland have received from Mountain Railways, Ltd., proposals for the construction of an electric railway from Ambleside to Keswick—a distance of 16½ miles. The estimated cost of the scheme is £150,000, and it is proposed to make the line of standard gauge, to enable the trains to run in conjunction with the London and North-Western system. A great deal of opposition has been incurred by the proposals.

Wolverhampton.—FARE REVISION.—On March 14th the Town Council decided to apply to the Minister of Transport for an order modifying the statutory provision regulating the charges to be made for passengers on the Corporation tramways. An interim order has been issued enabling the Corporation to charge—for the conveyance of passengers other than artisans, merchants, and daily labourers—fares not exceeding 1½d. per mile, or portion thereof, and for the conveyance of artisans, mechanics, and daily labourers' fares not exceeding 1d. per mile, or portion thereof.

TELEGRAPH AND TELEPHONE NOTES.

Cable Interruptions.—The earth tremors which were recently experienced in the Sydney, N.S.W., suburbs, occurred again on June 17th. By a singular coincidence, and the second time within the past few days, the Eastern Extension Telegraph Co.'s cable service has been seriously interrupted. In response to inquiries on the subject, one of the company's officials said that the seriousness of the breakdown seemed almost to suggest the occurrence of a "submarine earthquake," all the company's Red Sea lines having suffered.—*Reuter's Trade Service* (Sydney, N.S.W.).

Russia.—TELEGRAPH SERVICE TO BE REOPENED.—The Copenhagen correspondent of the *Morning Post* states that at the Great Northern Telegraph Co.'s general meeting it was stated that negotiations concerning the reopening of the Russian cable service will soon be completed. The Petrograd station, of which all the instruments are intact, will then be reopened, and the stations served by the Russian land lines *via* Irkutsk and Vladivostock will be able to communicate with Europe and Eastern Asia.

The Post Office.—ADVISORY COMMITTEE.—The Post Office Business Advisory Committee met on June 15th, for the first time, when the Postmaster-General (Mr. Kellaway) took the chair, and 17 out of 19 members were present. Members of the Committee were told a good deal about the administration of the Post Office, and there was an informal discussion on general matters, especially telephones and telegraphs. The Committee, which will meet again shortly to plan its scheme of work, has been instituted to advise the Postmaster-General on the steps to be taken to give an efficient service at less than the present rates.

U.S.A.—TELEGRAPHIC ERRORS.—The contentions of the Western Union Telegraph Co., that it cannot be held liable for damages caused through errors in transmitting messages while its lines were under Government control, have been upheld by the Supreme Court, and a decision of the South Carolina Courts awarding damages to Mr. S. B. Poston, a cotton dealer, on this ground was reversed.—*Manchester Guardian.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Aldershot.—July 2nd. Urban District Council. Electric light wiring, Park housing scheme. F. Garside, electrical engineer.

July 5th. Urban District Council. Electricity Department. E.h.p. switchgear ; l.p., d.c. switchboard, rotary converters and starting gear. (See this issue.)

Australia. — MELBOURNE. — August 10th. Victorian Railways. 250 core-type impedance bonds for power signalling, with a capacity of 1,000 amperes per rail ; also 50 miles of solid insulated copper wire, No. 14 Brown & Sharpe gauge, and 50 miles of solid insulated copper wire, 16 standard gauge.

July 27th. Victorian Railways. Incandescent lamps for electric car lighting : 24,000 metal filament, 46 W, 116 V ; 4,000 carbon filament, 32 W, 140 V. 5-h.p. electric motor, controller and resistances, or, alternatively, 5-h.p. electric motor and equipment.*

August 17th. 3,000 sets of renewals for caustic soda primary cells.

August 30th. Board of Works. Four electrical centrifugal pumps, each with a capacity of twelve million gallons daily.

September 7th. Victorian Railways. Sixteen sets of air-brake equipment, 450 to 600 V, d.c., for single-deck tramcars.—*Reuter's Trade Service* (Melbourne).

SHIRE OF HAMPDEN (VICTORIA).—August 17th. Boiler-house plant, steam-driven electricity generators, transformers, meters, switchgear, cables, poles. Specifications from Mr. H. C. Ingleton, Shire Hall, Camperdown, Victoria.—*Tenders.*

Edinburgh.—July 14th. Electricity Supply Department. H.p. steam pipes and valves. Specification 33. (June 17th.)

Glasgow.—June 27th. Electric lighting work at the extension to the administrative building at Lightburn Hospital, near Shettleston. Mr. Jas. A. McCallum, Clerk to the Committee, 15, West George Street, Glasgow.

Liverpool.—June 25th. Electric supplies for the West Derby Board of Guardians. H. P. Cleaver, Clerk, Brougham Terrace.

London.—L.C.C. July 11th. Supply and laying h.p. electric cables, &c. (See this issue.)

L.C.C.—July 11th. One 8,000-kW steam turbo-alternator and exciter, condensing plant, &c. ; seven 1,000-kW rotary converters, static transformers and accessories. (June 10th.)

Manchester.—June 28th. Electricity Committee. Supply of cable requirements during six months ending December 31st, 1921. Mr. F. E Hughes, Secretary, Electricity Department, Town Hall, Manchester.

June 28th. Electricity Department. 27,000 yards weldless-steel spigot and socket tubes. (June 17th.)

New Zealand. — WELLINGTON. — August 9th. Public Works Department. Suspension-type porcelain insulators for the Waikato power scheme.*

Rhyl.—July 9th. Urban District Council. Electricity Department. 1,000 yd. ·3 × ·3 × ·15 l.p. cable, 1-5-way feeder pillar switchboard panel and gear. (See this issue.)

South Africa.—July 5th. Electrification of Capetown-Simonstown and Durban-Maritzburg railway lines.

TRANSVAAL.—Rand Water Board. September 9th. Erection of a complete installation of mechanical or other filters capable of filtering 5½ million gallons of water per 24 hours at the Vereeniging main pumping Station (Contract No. 232). Copies of the contract documents may be obtained from the Chief Engineer, Rand Water Board, Johannesburg, upon a deposit of three guineas.*

BARBERTON.—July 29th. Municipal Council. Plant in connection with the proposed scheme for the supply of electricity :—Two steam boilers, two 75-kW steam-driven alternators, switchboard, and instruments, steel chimney piping, feed pumps, cables, &c., steel poles, conductors, &c., transformers, house service meters, &c. Specifications, £2 2s., from Prof. W. Buchanan, 75, Louis Botha Avenue, Johannesburg.

Uruguay.—MONTE VIDEO.—August 18th. State Electricity Works. Steel petroleum tank, Worthington duplex steam pump for oil, 250 metres steel tubing.*

September 3rd. The Commercial Secretary to His Majesty's Legation at Monte Video reports by cable to the Department of Overseas Trade, that the local authorities are advertising for tenders for the supply of 59,250 metallic-filament lamps of assorted sizes, from 10 to 300 c.p., 225 volts, which are required by the State Power House.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Aldershot.—Urban District Council :—

Single-wire armoured cable, for bulk supply of electricity, £5,476.—Callender's Cable and Construction Co., Ltd.

Australia.—The Victorian Electricity Commission has accepted Messrs. Babcock & Wilcox's tender of £178,000 for the complete installation of boiler plant at the Newport power house. It is expected that a substantial portion of the tender money will be expended locally.—*Reuter's Trade Service* (Melbourne).

Ayr.—Town Council. Electric light installation, 40 houses, G. Gillanders, Glasgow.

Barnes.—Fire Brigade and Lighting Committee. Recommended :—

Twelve months' supply current limiters.—Electric Utilities, Ltd.

Birmingham.—Messrs. F. Hogg & Co., of Smethwick, have received the contracts for electrical installations for the Park Road Congregational Church and Schools at Aston, and the Wesleyan Methodist Church and Schools, at Smethwick.

Glasgow.—Electricity Committee :—

Cables for 12 months.—Callender's Cable & Construction Co., Ltd.; Enfield Ediswan Cable Works, Ltd.; W. T. Glover & Co., Ltd.; General Electric Co., Ltd.
Meters for 12 months.—Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; Chamberlain & Hookham; Metropolitan-Vickers Electrical Co., Ltd.
Crane and grab for the Dalmarnock power station, £1,064.—W. Morgan and Co., Ltd.
Two overhead travelling cranes, £1,540.—Sir W. Arrol & Co., Ltd.
Rotary converters.—British Thomson-Houston Co. (£9,800) and General Electric Co., Ltd. (£9,074), each for one set.
Transformers, £1,556.—Metropolitan-Vickers Electrical Co., Ltd.

Town Council. Accepted :—

Electrical work in connection with the Municipal Buildings, £6,911.—Johnston, Park & Co.
Electric lighting at Knightswood Hospital.—W. C. Martin & Co., Ltd.

Gravesend.—A contract for the electrical work in connection with the Gravesend Borough Council housing scheme (King's Farm Estate) has been received by the Sturdy Electrical Co.

London. — HAMMERSMITH. — Electricity Committee. Recommended :—

Relining overhead coal bunkers with reinforced concrete, £1,150.—Griggs and Son.
Exciter switchboard, £135.—Park Royal Engineering Works, Ltd.
Steel framework for the foundations for the first 10,000-kW generating set, £475.—Sanders & Foster, Ltd.
Concrete foundations for the 10,000-kW set, £1,150.—J. Dorey & Co., Ltd.
Circulating water pipes and supports in connection with the condensing apparatus, £4,506.—Mechans, Ltd.

STOKE NEWINGTON.—Electric Lighting Committee. Recommended :—

H.p. and l.p. switchboards, £4,976.—General Electric Co., Ltd.
Extra cubicle accommodation, £115.—General Electric Co., Ltd.
Cables (various sizes).—W. T. Henley's Telegraph Works Co., Ltd.

Kilmarnock.—Town Council :—

Steelwork for extensions to tramcar sheds, £549.—Redpath, Brown and Co., Ltd.

St. Boswells.—The contract for installing electric light and power at Eildon Hall, St. Boswells, for the Duke of Buccleuch, has been secured by Messrs. Lowdon, Bros. & Co. The power is to be developed by a water turbine.

Taunton.—Town Council.

Anglo-American Oil Co., Ltd.—600 tons of standard fuel oil, for the electricity works, £5 5s. per ton.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, June 24th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

Electrical Trades' Benevolent Institution.—Monday, June 27th; at 2.30 p.m. At the Cable Makers' Association Offices, Sardinia House, Sardinia Street, W.C. Confirmatory meeting of alteration to rules, giving additional power to local advisory committees.

Institution of Civil Engineers.—June 28th, 29th, 30th, and July 1st. At the Institution of Civil Engineers, Great George Street, Westminster. Engineering Conference.

Institution of Electrical Engineers.—Thursday, June 30th. At the Natural History Museum, Cromwell Road, S.W. From 8.30 p.m. to 11 p.m. Conversazione.

Institution of Mechanical Engineers.—Thursday, June 30th; at 10.15 a.m. Friday, July 1st; at 10.30 a.m. At the Institution, Storey's Gate, S.W. London Summer Meeting. Conference on "The Means of Increasing the Thermal Efficiency of Heat Power Plants."

NOTES.

Summer Time.—A Bill to make permanent the yearly introduction of "Summer Time," which at present is legalised under regulations which were introduced during the war period, has been introduced in Parliament by Sir John Baird, the Under Secretary of the Home Office.

Fatality.—An inquest was held at Dewsbury, last week, on the body of Ernest Holroyd Priestley (24), foreman station electrician at the Thornhill power station of the Yorkshire Electric Power Co., Ltd. While examining the rear of the operating mechanism on the top of some h.p. switchgear he received a shock at 10,000 volts. Mr. Benjamin Benyon, charge engineer, said deceased had been instructed that only one section of the switchboard was "dead," and he should not have entered the cubicle where he received the shock.

The Electrical Trades Benevolent Institution.—The general meeting to confirm the alterations of the rules which were passed at the annual general meeting, will be held at the Cable Makers' Association's Offices, Sardinia House, Sardinia Street, W.C. 2, on Monday, 27th inst., at 2.30 p.m.

A Municipal Vehicle Demonstration.—The annual conference of the Institution of Municipal and County Engineers, of which Mr. Norman Scorgie, M.Inst.C.E., borough engineer and surveyor, Hackney, is president-elect, was held in London from June 15th to 18th inclusive, and in conjunction therewith a demonstration of mechanically-propelled vehicles, &c., used in municipal work was arranged by Mr. E. F. Spurrell, borough engineer, Holborn, and hon. sec. of the Institution for the Metropolitan district, took place in Lincoln's Inn Fields, W.C., on the afternoon of June 16th.

The vehicles on view were operated to facilitate inspection by the visitors, and although the major portion of the exhibits was of a non-electrical nature, the exhibition was nevertheless of value, not only to municipal men, but to the general public. Members and visitors were invited to inspect two improved electric lamps which are located on the north side of High Holborn, east of Kingsway and opposite the Holborn tube station. The lamps, which are manufactured by the General Electric Co., Ltd., for street lighting purposes, give a very even distribution of light, and embody Mr. H. T. Harrison's patent which has been described in our pages.

The electric vehicles exhibited numbered five, including one of Messrs. Tilling-Stevens's well-known petrol-electric type. This was fitted with an end-tipping body operated by the electric motor which normally drives the vehicle, and the tipping gear is automatically controlled.

The General Vehicle Co., Ltd., had on view a 2-ton vehicle fitted with a side-tipping body, as used by the Bath Corporation, and Agricultural and General Engineers, Ltd., showed a Garrett 2½-ton vehicle with an electrically-operated end-tipping body, as used in the borough of Hampstead. The tipping is done by means of a separate motor placed under the driver's seat, and is automatically controlled. The vehicle will travel a distance of approximately 35 miles on a good level road on one charge of the battery, and the main controller is interlocked with the brake levers.

The Orwell electric dust van exhibited by the Hackney Borough Council was one of the four vehicles fitted with side-tipping gear supplied by Messrs. Ransomes, Sims & Jefferies, Ltd., two of 3½ and two of 2 tons capacity, which are engaged in house refuse collection in connection with an experiment which is being made of a daily collection from certain areas in the borough.

Finally, Messrs. Electricars, Ltd., had on view a 15-cwt. vehicle, the propelling energy for which is derived from a 300-Ah Edison battery. The body is end tipped electrically, and an outrigged motor drives each of the rear wheels through a shaft. The main controller is fitted with a spring so that the make-and-break action is speeded up, thus doing away with the burning which usually occurs on the first and second notches.

All the electric vehicles shown were more or less of standard types, and the newest thing noticed was the Tilling-Stevens body-tipping gear.

Appointments Vacant.—Electrical power station superintendent (Rs. 525 per calendar month), for the East Indian Railway Co.; chief engineer and manager for the Ipswich Corporation Electric Supply and Tramways (£900, rising to £1,200 by annual increments of £50). See our advertisement pages to-day.

The Radiation Resistance of Antennæ.—In a communication to the *Journal* of the Institution of Electrical Engineers, by A. Press, M.I.E.E., the loss of energy by electromagnetic radiation, quite apart from absorption effects, is likened to a compound hysteresis loss. This is because both the electric field and the magnetic field absorb energy from the system, but the quantum of energy returned is rather less than that taken up to charge the respective fields. After developing the mathematics for elliptical hysteresis, the antenna is treated as a transmission line loaded hysteretically because of radiation effects. The true voltage and current distribution values as a function of the antenna length then follow. As a result of this analysis the trough in the antenna resistance characteristic as a function of the impressed frequency is explained. The rising branch is to be ascribed to the capacitative radiation, quite apart from pure absorption effects. The falling branch is then seen to be due to the magnetic component of radiation. The minimum in the characteristic curve corresponds to the radiation condition in which the capacitative equal the magnetic hysteresis effects. The hysteresis constants per unit of length as obtained from the graphs are then to be made the means of comparing different antenna systems.

Telephones in Western Canada.—The telephone is considered an essential utility of Western Canadian life to such an extent that one telephone to every nine persons is found west of the Great Lakes, and telephone construction, both line and exchange, planned for the immediate future, is as large as, if not larger than, for any previous period. The business of telephony in this area is permanent and expanding, and offers a profitable field to manufacturers of instruments, exchange equipment, and line supplies. To a considerable extent the rapid progress of Western Canada has been aided by remarkably efficient telephone services. Western Canada is a country of long distances and relatively sparse settlement, and the telephone enables the farmer, many miles from town, to transact business with the facility of the city broker. Thus the rural telephone is installed in many far-away homes; of the total of 272,495 telephones in Western Canada, approximately 90,000 are rural.

The principal American and Canadian manufacturing companies are closely associated with the telephone operating services in Eastern Canada and British Columbia, and naturally supply the material used in those services, but the construction, ownership, and operation of the service in the three prairie provinces (Manitoba, Saskatchewan, and Alberta) are almost entirely Governmental. These three Government telephone departments are the principal free purchasing agents in Canada, and although they have had, in the past, of necessity to obtain much of their equipment from manufacturing companies connected with the privately-owned services, they have expressed, in no uncertain terms, their desire for new sources of supply and, in particular, look to the United Kingdom. H.M. Trade Commissioner at Winnipeg (Mr. L. B. Beale) has prepared a detailed report on the telephone services of Western Canada, from which the above has been extracted. The report, which shows the annual amount of business in telephone material available, and the chances of United Kingdom manufacturers and merchants of securing this business, should be applied for at the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1, quoting 4504 ED/PN.—*Board of Trade Journal.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—VISIT OF AMERICAN ENGINEERS.—In connection with the Engineering Conference convened by the Institution of Civil Engineers for next week, a deputation of distinguished engineers from the United States is visiting this country.

The opportunity will be taken to present the John Fritz gold medal to Sir Robert Hadfield, to whom it was awarded for his invention of manganese steel; the ceremony will take place on Wednesday morning at 10 a.m.

The deputation will be present at the Institution conversazione, to be held on June 30th. It consists of:—Mr. Ambrose Swasey (chairman), Messrs. Charles T. Main, Robert A. Cummings, John R. Freeman, and D. C. Henny (American Society of Civil Engineers), Messrs. Ira N. Hollis and Jesse M. Smith (American Society of Mechanical Engineers), Colonel Arthur S. Dwight, Mr. C. F. Rand, Dr. George Otis Smith, and Mr. W. Kelly (American Institute of Mining and Metallurgical Engineers), Dr. F. B. Jewett, Dr. A. E. Kennelly, and Major-General G. O. Squier (American Institute of Electrical Engineers), and six ladies.

About 10 p.m. Mr. Ambrose Swasey will speak in the Central Hall of the Museum, and he will be followed by Dr. F. B. Jewett, who will convey a message from the American Institute of Electrical Engineers to the Institution of Electrical Engineers.

Institution of Production Engineers.—A general meeting of the Institution will be held at the Institution of Mechanical Engineers, Storey's Gate, S.W. 1, on Friday, July 15th, at 7.30 p.m., when all who are interested in matters appertaining to production are invited to attend.

At this meeting, Mr. Max R. Lawrence, M.I.M.E., M.I.A.E., will deliver a paper on "Production and the Engineer."

The proposed activities of the Institution during the coming winter session will be outlined, and announcements will be made with regard to the election of various grades of members.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR L. W. WILD, M.I.E.E., physicist to Automatic and Electric Furnaces, Ltd., sailed on the *Olympic* on 15th inst., for New York, where, by arrangement with leading manufacturers, he will give practical demonstrations of Wild-Barfield automatic steel hardening furnaces.

MR. G. H. PURKISS, assistant superintendent of the traffic department of the Southend-on-Sea Corporation Tramways, who has resigned, after being for 16 years on the staff, has been presented by his colleagues with a canteen of cutlery and silver.

A bonus of £100 per year is to be granted to Fleetwood's electrical engineer in respect of the period, January, 1921, to March, 1922.

Dover Town Council has decided to offer the following reduced salaries to members of the electricity works staff:—Chief assistant (1914 salary, £200; 1920 salary, £538 and cost-of-living award), £400; mains engineer (£200 and £427), £300; senior shift engineer (£100 and £293), £236; second and third shift engineers (£94 and £287 and £78 and £287 respectively), £231; with the cost-of-living award. These officials are to be given notice to terminate their engagements, with the option of reappointment at the reduced salaries.

Hammersmith Borough Council Electricity Committee has appointed MR. J. A. WEST to the position of engineer-in-charge, at £412 + cost-of-living bonus, at present £26; there were 90 applicants.

MR. HERBERT TETLOW, manager of the electricity department of the Bacup Corporation, was married last week to Miss Edith Holland, of Heywood.

A Press report states that MR. VICTOR BONE, who has been joint managing director to Messrs. Ransomes, Sims & Jefferies during the last four years, will, in the course of a few months, be leaving Ipswich for Lincoln, taking up the position of works director on the board of the associated firms of Ruston & Hornsby, Ltd. The vacancy has arisen through the retirement of MR. ALEXANDER RAMSAY, on his appointment to the post of permanent chairman of the Birmingham and District Engineering Employers' Federation. Mr. Bone's successor at the Orwell Works will be MR. FRANK AYTON, chief engineer and manager of the Ipswich Corporation Electric Supply and Tramways Departments.

PROF. T. MATHER, Professor of Electrical Engineering at the City and Guilds (Engineering) College, Imperial College of Science and Technology, has been appointed for this session as external examiner in Electrical Engineering for the diploma examinations of the Bradford Technical College.

MR. G. H. ROWBOTTOM has been appointed sales manager to the Clyde Valley Electrical Power Co. in succession to the late Mr. R. Robertson, and he will take up his duties on July 1st. Mr. Rowbottom completed his studies at St. Andrew's University, where he obtained his B.Sc. Degree, and was Medallist in Electrical Engineering. He served his apprenticeship with Messrs. Alley & McLellan, Polmadie, and for many years has been associated with Messrs. Crompton & Co., Ltd., Chelmsford, on both their engineering and commercial staffs, latterly being assistant branch manager in their Glasgow Office.

At the conclusion of the last "discourse" of the session at the Royal Institution, says *The Times*, the Duke of Northumberland presented a gold loving cup to SIR JAMES and LADY DEWAR, a gift from the members on the occasion of their golden wedding.

MR. C. N. WILLIAMSON is on a visit to this country in connection with the interests of his firm (C. N. Williamson & Co., electrical merchants, Auckland, New Zealand), for whom he is arranging agencies for British manufacturers. His address is 53, Beech Road, Stockport.

Obituary.—MR. R. G. KNIGHT.—The death took place, on June 12th, of Mr. Richard George Knight, who was in business as an electrical engineer at 11, Sundridge Parade, Bromley (Kent). He was 51 years of age.

SIR T. WRIGHTSON.—We regret to announce that Sir Thomas Wrightson, of Head, Wrightson & Co., Ltd., passed away on Saturday last at the age of 82 years. He was a director of the North-Eastern Steel Co., Ltd., and chairman of a colliery company. He early served his articles as an engineer. In later life he devoted himself to public affairs and to political matters. His business activity, however, did not prevent him from devoting a great deal of time to the science of acoustics, in which he had the support of Lord Kelvin, and of which he made a lengthy investigation in association with Prof. Arthur Keith.

NEW COMPANIES REGISTERED.

Thermics, Ltd. (175,200).—Private company. Registered June 14th. Capital, £300 in £1 shares (100 "A" and 100 "B"). To carry on the business of electrical, mechanical, chemical, heating, ventilating, gas, hydraulic, water, and general engineers, chemists, steel converters, tin, copper and general smiths &c. The permanent directors are: W. W. Nobbs, 50, Fairhazel Gardens, West Hampstead, N.W.6; S. Evling, 29, Hartswood Road, Shepherd's Bush, W.; A. B. C. Licence, 56, Western Road, Romford, Essex; P. A. Lothbury (formerly P. A. Laubach), 3, Dennington Park Road, West Hampstead, N.W.6. Registered office: 2, Falcon Square, Aldersgate Street, E.C.

Anglo-Persian Development Syndicate, Ltd. (175,207).—Private company. Registered June 15th. Capital, £300 in £1 shares (100 founders). To acquire from the Government of Persia or other Governments concessions, grants, decrees, rights, powers and privileges; to carry on the business of a waterworks, electric light and gas works company in Persia, &c. The subscribers (each with one share) are: E. J. White, Lismore, Rockleigh Avenue, Westcliff-on-Sea, clerk; S. G. Parker, 52, Yerbury Road, Tufnell Park, N., clerk. The first directors are to be appointed by the subscribers. Solicitor: H. R. Turner, Kennan's House, Crown Court, Cheapside, E.C.

Alfred H. Hughes & Co., Ltd. (175,228).—Private company. Registered June 16th. Capital, £20,000 in £1 shares (6,000 10 per cent. cumulative preference). To take over the business carried on at 39, 39a and 41, International Exchange, Church Street, Birmingham, as "Alfred H. Hughes & Co.," and to carry on the business of manufacturers and repairers of and dealers in gas controllers and gas engines of all kinds, mechanical, electrical and general engineers, &c. The first directors are: A. H. Hughes, The Mount, Berkswell, Warwick; T. Wallis, One Ash, Kettering; R. A. Boucher-Giles, Rock Mount, Wolverley, Kidderminster; A. C. Brown, no address given; E. F. Wallis, no address given. Secretary: F. A. Hughes. Registered office: 39a, International Exchange, Church Street, Birmingham.

Heath & Serena, Ltd. (175,217).—Private company. Registered June 15th. Capital, £2,000 in £1 shares. To carry on the business of electrical and mechanical engineers, iron, steel and metal merchants, manufacturers of and dealers in motor and steam engines, motor cars, &c. The subscribers (each with one share) are: G. E. Heath, 8, Oakleigh Gardens, Whetstone, N.20, engineer; R. Serena, 29, St. James Street, S.W., director of limited company. The first directors are not named. Solicitor: L. Goldberg, 2-3, West Street, Finsbury Circus, E.C.

Price's Electrical Supplies, Ltd. (175,260).—Private company. Registered June 17th. Capital, £3,000 in £1 shares. To carry on the business of manufacturers of and dealers in goods, instruments, devices, appliances, apparatus, and fittings used in the manufacture, generation, distribution, accumulation, and employment of electricity or gas, water, heating, lighting, motor oil, mechanical, steam, and other power, &c. The first directors are: W. H. Price, Woodlands, Little Aston, Aldridge, Staffs; W. F. Cox, Heathcote, Court Lane, Erdington, Birmingham. Secretary: W. F. Cox. Registered office: Calton House, Great Charles Street, Birmingham.

Nazeing & District Electric Supply Co., Ltd. (175,258).—Private company. Registered June 17th. Capital, £7,000 in £1 shares. To carry on the business indicated by the title. The permanent directors are: E. Grace, 306, High Road, Tottenham, N. 17, electrical engineer; H. Rose, 406, High Road, Tottenham, wine merchant; W. B. Tweddill, 109, Bruce Grove, Tottenham, N. 17, electrical engineer; E. Silver, 446, High Road, Tottenham, N. 17, haberdasher. Solicitor: J. Prag, Gray's Inn Chambers, 20, High Holborn, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Malaga Electricity Co., Ltd.—£10,000 debentures created in April, 1897, and £14,417 debentures issued in February, 1898, are now first registered, pursuant to Section 12 of the Act of 1907. At the same time, satisfaction of the whole £24,417 and also of £20,321, debentures issued from January, 1902, to February, 1905 (being all the debentures previously registered) is notified. The repayment was by instalments from July, 1912, to December, 1920.

C. F. Elwell, Ltd.—Mortgage debenture for £3,000, dated June 3rd, 1921, to secure £3,000, charged on freehold factory, &c., at Camberwell (subject to prior charge for £2,500) and the company's general assets, including uncalled capital. Holders: Radio-Communication Co., Ltd.

Balsera's Patents, Ltd.—Particulars of £3,000 debentures authorised January 31st and all issued June 1st, 1921, charged on the company's undertakings and property, present and future, including uncalled capital.

Barnsley and District Electric Traction Co., Ltd.—Particulars of £20,000 debentures authorised May 26th, 1921, whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital subject to trust deed dated April 8th, 1903, and acknowledgment of debt dated January 30th, 1908, securing £21,000 debenture stock.

Alderley & Wilmslow Electric Supply, Ltd. (47,663).—Return dated May 11th, 1921. Capital, £30,000 in £1 shares (10,000 preference). 15,000 ordinary shares taken up. £15,000 paid. Mortgages and charges, £15,000.

West London & Provincial Electric Supply Co., Ltd. (62,097).—Return dated June 1st, 1921. Capital, £150,000 in 70,000 ordinary and 80,000 preference shares of £1 each. 23,354 ordinary and 49,077 preference shares taken up. £1 per share called upon 15,854 ordinary and 41,577 preference shares. £57,431 paid. £15,000 considered as paid on 7,500 ordinary and 7,500 preference shares. Mortgages and charges, nil.

Aluminium Corporation, Ltd.—Particulars of £150,000 debentures, authorised January 19th, 1921; present issue £100,000, charged on the company's undertaking and property, present and future, including uncalled capital.

CITY NOTES.

Callender's Cable and Construction Co., Ltd.

The annual meeting was held on June 16th, Sir J. Fortescue Flannery, Bt., M.P., in the chair. Proposing the adoption of the report, the chairman said that the past year had again been one of exceptional pressure and difficulty. The volume of business had been very large, and had taxed the resources of the company to the utmost. The new workshops for the manufacture of e.h.p. cables had been completed, and were already turning out that type of cable which would be very largely employed in future for electrical power distribution. Further, they had taken over the workshops which were erected on their land for the purpose of manufacturing war material. The Picardy works had now been completely converted for the purpose of manufacturing ordinary telephone cable, such as was used by the General Post Office, and had been actively employed all the year, and the other shops would be utilised for more peaceful operations. They would have been unable to cope with the orders placed in their hands, even with the extensions, had they not successfully installed the three-shift system, which enabled the company to increase the output of the factory very materially. At the last meeting he told them that the amount of work which was in front of them rendered it probable that they would have to appeal for further capital. That appeal was made shortly after the meeting, and further capital, amounting to £500,000, comprising 400,000 "B" preference shares of £1 each and 100,000 ordinary shares of £1 each, was raised. Of course, they could not expect to handle their increasing business without some increase in the cost of running, and that was seen in the item of £137,276 for general expenditure. Their ordinary expenditure had been largely increased owing to the heavier salaries and wages and war bonuses which had been paid, and to the higher cost of every item which went to form their general charges. They had also felt it necessary to increase their activities abroad, and the organisation of overseas trade was an operation which required much patience, time, and money. The consequence was that, whilst they had made a greater profit, not so much as they hoped was left to them. Nevertheless, the profit was sufficient to pay the same dividend as in the previous year, viz., 15 per cent., to deal effectively with the requirements as to depreciation, and to add the balance of several thousand pounds to the carry forward. They would not be surprised to learn that the period had been one of constant strain, and of extreme difficulty at home and abroad. Towards the end of the year they began to feel the competition of other nations, whose currency had become depreciated, and whose workpeople had recognised the necessity to work hard, so as to restore the commercial and industrial prosperity of their country. That competition still remained severe, but as the trade of those countries improved, and their exports increased, the advantage they at present enjoyed in a depreciated currency would tend to disappear. The relations between the company and its employés were excellent. That remark did not mean that there had been no labour troubles in the period, but rather that good sense on one side and fair treatment on the other, had led to the conclusion of a settlement, which they believed would have excellent results. The managing director, Sir Tom Callender, paid a visit to India in the earlier part of this year. His visit had materially strengthened their position in that country. Their agents in Australia and South Africa had sent them large orders during the period, and their recently-opened branch in South America had been eminently successful, and large contracts were in hand for that continent. Further developments were in progress. The business in the Near East was growing, but had been held up by the present unsettled condition and exchange disparities. The works profit for the year, after deducting all charges on manufacturing account and contracts, was, in round figures, £381,120, or about £90,000 more than for the year 1919. The re-establishment of their foreign trade, as well as the heavy advances in salaries and other expenses at home, had absorbed a good deal of that profit and left them with £182,919. From that the directors had written off £30,800 as depreciation on property and furniture, and after paying debenture interest and preference dividends, they had a balance of £97,919. Adding to that the balance from 1919, £105,803, gave a total of £203,723. They were carrying forward £108,000, which was about £2,300 more than was brought in from 1919. With regard to the future, the output of the factories during the earlier months of this year exceeded the output for the same period of last year, but there had been a very grave and serious dislocation within the last few weeks. As a result of the dispute in the coal industry, they found themselves at Erith faced with the alternative of exhausting their stocks of fuel without any possibility of replenishing them, or else closing the works. After giving the matter full consideration they decided that the better course was to close the factory. Therefore, about the beginning of May they paid off the workpeople at Erith, and had since been employing only a nucleus staff. The effect of that could not fail to make itself felt in the results of the present year, although they were hoping that the good trade in the earlier part of the year, and the business which was awaiting them when they again resumed operations, which they hoped to do immediately, would

compensate for any loss that was incurred owing to that unfortunate stoppage. It was very evident, and it could not be repeated too often, that the prosperity of that company and of every other manufacturing company in this country, was vitally dependent upon the output and the reasonable certainty with which it could fulfil its obligations to its customers, and that the commercial prosperity of the nation must come to an end if they were liable to such stoppages, or had to consider them as a possible permanent feature in their business. Those frequent disputes with labour, even when they were not with their own people, but between employers and employed in other industries, had their ill-effect upon the general manufacturing industries of the country, and when it was remembered the large amount which they themselves annually paid in wages, which last year amounted to over £600,000, the workers must recognise that a dispute of two months which deprived them of a material part of that sum in wages, involved them in a personal loss which could hardly be recovered during the year. There was another burden which the companies of this country had to bear at the present time, and that was the pressure of taxation and the cost of local government. Limited companies, like themselves, who were large ratepayers, as such had no voice in the control of the area where works were situated, and yet contributed a very large sum to the cost of local government, a sum which was constantly increasing. In their case, they had paid in rates and taxes during the year 1920, a sum equivalent to a dividend of 15 per cent. on the ordinary share capital. That was a very heavy burden to bear, and one which handicapped them, especially in their foreign trade.

Sir T. O. Callender, in seconding the motion, said that, as the chairman had stated, the past year had been one of intense anxiety and great difficulty. They had had to face many electrical problems, including new types of cable work, and they had got through those difficulties successfully because they took in hand early in the day the construction of their e.h.p. cable works. That new branch of the factory had been of the greatest service to them. They were looking forward to a great increase of business in that type of cable. They had large orders in hand which would keep them busy for some time, and although the coal strike had make a big hole in their output, they were hoping to make good that deficiency during the months that were to come. When trade was reasonably good, and when commerce once more got back into its ordinary run, there was no question that very large electrical works would have to be overtaken, and the advent of the new period under the Electricity Commissioners would bring to them and other cable makers large contracts. With regard to their foreign work, for the present at least they had been compelled to close their books. That was a disappointment to them, because immediately after the war they had spent a good deal of money and time in securing a footing in various countries on the Continent. Up till quite recently what they had done in that direction had been very successful. Now, however, that Germany had entered the field in active competition, and owing largely to the fact that the German manufacturer was hardly taxed at all, coupled with the extraordinary condition of the exchange, and to the excellent way in which the Germans were working, they had found it impossible at the moment to compete with the Germans on the Continent. They believed, however, that some of those conditions would be altered before long, and they looked forward at no distant date to resuming their Continental business. In the meantime, it was a closed door to them. On the other hand, their business elsewhere was continuing to increase, and they approached the remainder of the year with great confidence. They believed that, subject to no other unfortunate disputes or stoppages occurring, they would have on the whole quite a good year. They were looking forward to a speedy termination of the coal strike, but in the meanwhile they had not been idle. They had converted several of their boilers for oil burning, and from their experience they thought it probable that the substitution of oil for coal might have a good effect in many directions, and they might have to extend it very widely in their factories.

The report was adopted.

United River Plate Telephone Co., Ltd.

The thirty-fifth annual ordinary general meeting was held on June 14th, Sir Frederick Green, K.B.E. (the chairman), presiding. The chairman pointed out that the earnings in Argentina and London, including profit on exchange, amounted during 1920 to £1,096,373, as against £976,168 in 1919, an increase of £120,205, and that the expenses, including maintenance, management in Argentina and London, and income and corporation tax, with the usual provision for the depreciation of plant, amounted to £855,606, as compared with £764,076 in the previous year, an increase of £91,529, resulting in a profit of £240,767, an increase of £28,675. Working expenses showed a considerable increase over those of the previous year. This was due partly to the growth of the business, but still more to higher wages and costs. The increased telephone earnings were something between £90,000 and £100,000. The total increase in earnings from all sources was over £120,000. The London expenditure, including £5,000 stamp duty on the increased capital, amounted to £19,684, and income tax and corporation tax to £93,912, together making a total of £113,597. The income tax debit was some £17,000 less than it would have been, in consequence of sundry successful claims against this tax in respect of previous years. The addition to the plant account was £374,587, and to real estate £55,315. The former amount was much greater than for 1919, and was, in fact, the largest addition to the plant account in the history of the company. Real estate (£55,315) was about the same as in the previous year, and consisted of new exchange sites, and some buildings which it had been found advantageous to purchase. Securities, consisting mostly of Government War Loans, amounted to £150,460, a sum considerably less than that shown in the previous balance sheets. Stocks of material stood at £264,278, a large sum, but the higher prices partly accounted for this. It was necessary, too, to hold large stocks as the work was carried on so far from sources of supply. Bills receivable and cash amounted to £45,956, a smaller amount than last year, but this was the natural consequence of increased activities in plant extensions. On the debit side of the balance sheet, the general reserve fund included the appropriation made at the last meeting, and amounted to £556,138, and the reserve for renewal of plant to £1,206,091. The latter figure included the provision made for 1920 at the usual rate, less the cost of the plant replaced. A very considerable amount of new plant had been shipped this year, and before long should be brought into service, and this would enable the company to reduce its list of waiting subscribers, which now amounted to more than 11,000 in the city of Buenos Aires alone. It would not be possible, however, to satisfy all until the new automatic exchanges were working, and this could not now take place until early next year. During the year under review 5,431 new subscribers had been added to the system, making the total number of stations 83,602, as against 78,171 at the end of 1919. These additions had been rendered possible by the opening of an entirely new exchange. The Argentina Government had issued permits for new lines for connecting several important towns to the national system and the construction of some hundreds of miles of new routes had been carried out. Several small independent enterprises on these routes had been absorbed, and arrangements had been made to take over the La Bahiense system, which was the second largest in the Republic. The present rates were far too low, and it was hoped that authority to increase them would soon be granted by the Government. The directors had decided to issue 108,000 new ordinary shares to meet prospective capital expenditure upon arrears of work. These shares would be of £5 each, and the ordinary shareholders would be entitled to take one new share for every three ordinary shares held. The report and accounts were adopted, and the retiring directors and auditors re-elected.

Madras Electric Supply Corporation, Ltd.

The annual meeting was held on June 15th, Mr. James Gray (chairman) presiding. The chairman said the accounts showed marked progress in every direction. The increases in the number of new consumers connected, the total connections in kilowatts, and the electricity sold had all been well maintained. It was estimated that the balance of revenue, apart from all questions of exchange, had increased by £20,000, but it should be remembered that the whole of 1920 had had the benefit of the increased tariff of 5 annas, whereas 1919 had had only five months. The balance of revenue account amounted to £81,446, to which had to be added £4,580, the dividend on shares in the tramway company, and £1,401 from interest on Treasury bills. These made a total of £87,427. On the debit side of the latter account there appeared the usual items for interest and redemption of debentures under the sinking fund. The sum of £20,000 had been debited for depreciation and renewals, which was £6,000 more than last year. Provision had been made for income tax paid and payable in India, amounting to £6,325, also £4,000 for corporation profits tax. The balance of net revenue for the year was £40,721. Adding £7,114 brought forward from last year, there was available for distribution £47,835. These results were obtained under somewhat adverse circumstances, as, in addition to the stoppage of the tramways between January 26th and February 4th, 1920, there was a strike of the company's employés, which began on May 25th and lasted until June 22nd. In the balance sheet the total of the capital account remained as before, but the number of ordinary shares showed an increase of 1,330, and the preference shares a corresponding reduction. The loan from bankers in Madras appeared as £22,187 10s., compared with £35,102 17s. 5d. at the end of 1919. At the last general meeting it was explained that the rupee floating liabilities and assets had been valued at 2s. at December 31st, 1919, with the exception of the loan from bankers, which it was considered prudent to convert at the actual rate of 2s. 4d. then ruling. At December 31st, 1920, exchange was 1s. 5¼d., at which rate the rupee liabilities and assets were converted, and this explained the reduction in the bank loan as it appeared in the balance sheet. Having regard, however, to a further reduction in exchange to about 1s. 3¼d., the board considered it desirable to pay off this loan entirely, and this was done in March last. On the assets side of the balance sheet, the sum of £16,234 5s. 2d. was shown as expended on works representing chiefly the building of a new sub-station at Royapuram, the equipment of the new sub-station at Mount Road, and extensions of mains. Through a variety of causes, shipment of the four 250-kW rotary converters had been seriously delayed, but two of them were in transit and the other two were ready for

shipment. The delay had caused great inconvenience and considerable loss of revenue, as there was a large amount of business waiting to be done. The increase of 1 anna for lighting and fans on a combined circuit was granted for a period of three years only from August 1st, 1919. The directors had applied to the Government, however, to withdraw the limitation as to period, and were very sanguine that their application would be favourably entertained.

The chairman, in reply to a complaint that the company's progress was behind that of other Indian concerns, pointed out that during the past six years the company's business had been developed entirely out of revenue, and if they had had command of new capital they would have made much greater progress. If it were possible to offer locally a portion of any new capital they might wish to raise, that would be done.

Edmundsons' Electricity Corporation, Ltd.

The accounts for the year ended March, 1921, show that after providing for income tax, mortgage and note interest, and debenture stock charges, the net profit is £16,053, as against £8,099 in the previous year. Including the balance brought forward (£10,090) the total available is £26,143, out of which it is proposed to pay a dividend for one year on the cumulative preference shares, requiring £12,000 and to carry forward £14,143. (Last year's report stated that owing to the necessity for conserving the company's financial resources, the directors were unable to recommend the payment of the cumulative preference dividend.)

CAPITAL EXPENDITURE AND GROSS PROFITS OF SUBSIDIARY AND OTHER COMPANIES.

Name.	Capital expended Dec. 31st, 1920.	Gross profit (before providing for capital charges and depreciation). 1920.	Load connected in kW. 1920.
Alderley	£56,075	£4,294	1,467 kW.
Bromley	166,978	13,485	5,479
Folkestone	250,595	16,485	6,560
Guernsey	166,808	10,501	5,785
Isle of Wight	288,764	15,875	6,937
Ilfracombe	35,970	2,193	1,116
Lancashire Co. ..	1,343,915	47,377	29,804
Lymington	38,661	3,375	964
Melton Mowbray ..	48,098	5,092	1,288
Newmarket	45,879	2,953	1,284
North of Scotland ..	187,288	18,440	5,017
Ramsgate	54,946	5,356	1,951
Scarboro' Trams ..	90,430	*less* 835	—
Salisbury	74,051	7,531	2,168
Urban Co. Group ..	1,339,987	117,004	46,892
Whitchurch	6,422	31	128
Wycombe	134,208	16,998	3,519
Cromer	34,565	668	749
Dorking	46,623	1,371	1,519
Frome	68,104	4,176	2,488
Hamilton	90,091	6,012	3,475
Surbiton	74,807	6,797	2,735
Total 1920	£4,792,655	£290,774	134,259 kW.
„ 1919	£4,227,129	£208,622	122,233 kW.

Annual meeting : June 30th.

Oriental Telephone and Electric Co., Ltd.

The annual general meeting was held in London on June 17th, the chairman, Sir H. Babington Smith, G.B.E., presiding. The greater part of the chairman's speech was a review of the directors' report, which was abstracted in our issue of June 10th (p. 759). Regarding the future of the Indian systems, he said that under the licences held by the Bombay and Bengal companies, and also by the Oriental Telephone Co. in respect of its Indian branches, the Government of India had the option of purchasing the telephone undertakings on defined terms on March 31st, 1923, provided notice was given not later than the end of March, 1922. If this power was not exercised by the Government in 1923, the licence gave a similar option in 1928, 1933, 1943, 1953, and the licence finally expired in 1963. The directors had represented to the Government that it was impossible to carry on a telephone system with efficiency if the remaining tenure was short, and uncertain. It was essential that plans for development should be laid well in advance of requirements, and that capital expenditure should be incurred which would not be immediately remunerative; but it was obvious that a company with an expiring tenure could not, without injustice to its shareholders, spend money on plant which would yield no return before the date of transfer, and would then be sold at a depreciated value. If the decision should be against purchase in 1923, they had asked that, in the general interest, the companies should be given a secure tenure for a considerable period, as well as authority to increase the rates to an extent necessary to enable them to cope with the high working costs now obtaining. Last year they had had reason to think that the Government was likely to exercise its option to purchase; at the present time there was reason to think to the contrary.

The chairman, in reply to questions, said that, as he mentioned last year, the liquidation of the Egyptian Co. was only held up because of an outstanding question with regard to income tax between the liquidator and the Inland Revenue authorities. He trusted that before they next met the liquidation would have been completed. With regard to the question as to whether it was necessary to place such large sums to reserve, his answer was that in a telephone business it was extremely prudent to strengthen the reserves with a liberal hand. Depreciation of plant was always large, but it might be larger than was anticipated owing to the progress of invention, while in the case of this company there were so many uncertainties as to the termination of licences, the outcome of purchase terms, &c. Respecting the capital reserve account and the depreciation and general reserve account, he said that these were in part represented by investments—namely, War Bonds—and in part by assets, shown on the other side of the balance sheet, consisting of plant, land and buildings, stores, and also holdings in subsidiary companies.

The resolution was unanimously carried.

British Electric Traction Co., Ltd.

The gross profit during the year ended March 31st, 1921, was £264,773, against £246,717 for the preceding year. The general expenses were £44,575, leaving a net profit of £220,197, plus £150,422 brought forward. After deducting debenture stock interest, £85,136, there is a balance of £285,483. There is to be placed to reserve £12,349; 6 per cent. is to be paid on the cumulative participating preference stock, and 4 per cent. for the year on the ordinary stock, leaving £177,319 to be carried forward. No provision has been made for corporation profits tax (if any), as it is proposed to deal with it in the year in which it is paid. The net profit of £220,197 for the year compares with £211,316 for the preceding year. The aggregate receipts of the associated companies for 1920 showed an increase, but the expenses increased in a greater ratio, due in a large measure to the fact that in the majority of cases the associated companies were not authorised to increase fares and charges until the latter part of the year, although advances in wages were granted earlier in the year. The amount standing to the credit of reserve account at March, 1920, was £500,000, from which has been deducted £19,954, mainly in respect of loss on realisation of war stock. There has been added £7,605 in respect of discount on £11,286 5 per cent. perpetual debenture stock, and £8,067 4½ per cent. second debenture stock purchased during the year, and it is proposed to transfer £12,349 from revenue to reserve. The reserve will then stand at £500,000. The investments, which now stand at £3,861,816, show a decrease, as the result of sales on balance, of £165,975 compared with the preceding year. The investments yielded a revenue of £208,386, representing an average of 5.39 per cent. for the past year on the amount at which they appeared in the balance sheet, as compared with 5.28 per cent. for the preceding year. Mr. J. S. Austen was appointed chairman of the company in July last when that position was vacated by Mr. E. Garcke. Mr. Garcke, who retained his seat on the board, has since been appointed deputy chairman of the company. Meeting: To-day, Friday, at the Holborn Restaurant.

Stock Exchange Notices.—The Committee has specially allowed dealings in the following, under Temporary Regulation 4 (3):—

Johnson & Phillips.—£350,000 8 per cent. first mortgage debenture stock.

The undermentioned have been ordered to be officially quoted:—

Newcastle-upon-Tyne Electric Supply Co.—£250,000 4½ per cent. consolidated first mortgage debenture stock.

Prospectus.—*Pernambuco Tramways & Power Co., Ltd.*—The list is announced to close to-day (or before) in an issue of £500,000 8 per cent. prior lien debentures to bearer, at 96 per cent. The funds are required for the construction and equipment of lines necessary to obtain increase of fares, for the lighting programme and provision of extra rolling stock, the repayment of temporary loans, and provision of working capital for stores, &c.

Ransomes, Sims & Jefferies, Ltd.—The report for the year ended March, 1921, shows that after paying debenture interest and preference dividend, it is not considered practicable to recommend a dividend on the ordinary shares, having regard to present adverse trade conditions, fall in selling values, and the necessity for conserving the resources.

Victoria Falls & Transvaal Power Co.—Final dividend of 4 per cent., less tax, on the preference shares in respect of 1920, making 10 per cent.; 3 per cent., less tax, on account of 1921; and a dividend of 5 per cent., less tax, in respect of 1920 on the ordinary shares.

Chloride Electrical Storage Co., Ltd.—Dividend of 5 per cent., free of tax, on the ordinary shares, making 10 per cent. for the year. £25,000 to reserve; £5,000 to employés' benefit fund; £23,340 carried forward.

Lancashire Power Construction Co., Ltd.—Dividend of 7 per cent. on the participating preference shares for the year; £4,192 carried forward. It is stated that there will shortly be a further issue of capital.

Yorkshire (West Riding) Electric Tramways, Ltd.—Interim dividend of 3 per cent., less tax, on 6 per cent. cumulative preference for the half-year ending June 30th.

Belgium.—The report of the Société d'Electricité du Nord de la Belgique for last year shows a profit of 650,177 fr., as contrasted with only 24,869 fr. in the preceding 12 months.

Arbroath Electric Light & Power Co.—The annual report shows a net profit balance of £5,712, after paying interest charges and 5 per cent. dividend on preference shares. At the meeting on Friday last, Mr. George Balfour, M.P., chairman, presiding, it was agreed to pay a dividend of 8 per cent. (less income tax) on the ordinary shares, and an additional 1 per cent. (less tax) on the preference for 1920; to place £3,000 to the reserves and renewals fund, making this fund £10,000, and to carry forward, subject to payment of directors' and auditors' fees, £1,367. The past year has been the most prosperous in the history of the company. The share capital has been increased to £100,000, and it is proposed to make an issue of new shares in the near future for the purpose of repaying loans and providing for extensions of plant and cables to cope with increasing demands.

Globe Telegraph & Trust, Ltd.—Net revenue for year ended May, 1921, after deduction of expenses £287,772, plus £1,379 brought forward, together with £10,000 transferred from reserve for contingencies account, total £299,181. Total distribution on the ordinary shares 10 per cent., free of tax. Balance carried forward £2,181.

Birmingham District Power & Traction Co.—To renewals £8,000, dividend of 6 per cent. on the ordinary shares; carried forward £4,508.

[Owing to pressure on our space, several "City" items are held over to next week.—EDS. ELEC. REV.]

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets make an indifferent showing in the matter of business. The miners' refusal to resume work came as a surprise of a distinctly unpleasant character. Moreover, it was expected that even if the ballot showed an adverse majority to peace, the men would go back to work in rapidly-increasing numbers, but they show no disposition to do so far. Consequently the markets are slow and dull. There is a little investment business going on, and men still talk hopefully of a Bank Rate reduction now that the Federal Bank of New York has lowered its minimum. But even this hope is tempered by considerations arising out of the strike.

The Home Railway market is one of the chief sufferers in the latest financial malaise. Coal is undoubtedly the main cause of the investor's positive refusal to look at the stocks in this department. Underground Electric Income Bonds managed to maintain a firm front at 80½, but the £10 shares have dropped to 2½ and the 1s. shares to 7s. Districts have lost 1½ at 18¼. Metropolitans fell to 26, and the only stock in the market to show any firmness is Central London Ordinary Assented Guaranteed, which has risen 3 points to 48½. The company's non-assented ordinary stock stands at 31½, the deferred being 24½ and the preferred 34. But the guaranteed assented preferred ordinary has risen to 50 and the guaranteed deferred ordinary to 45½. London Electric £10 shares are better at £3. London and Suburban Traction preference eased off to 7s.; the ordinary are still half-a-crown.

Marconis have been as low as 43s. 3d., but a breath of buying restored the quotation to 2½. Canadians remain at 8s., and Marines at 25s. Marconi 7 per cent. preference have gone back to 2 3/16. Cable stocks are steady as a whole. Western ordinary at 16⅝ are 5s. lower, otherwise there is no change in this particular group. The Anglo-American issues maintain their rise of last week.

United River Plate ordinary are quoted 5½, which is ex the right to the allotment of one new share at £5 for every three old shares previously held. The rights are valued at about 5s. premium, and the new shares are being dealt in on this basis. Siemens ordinary are also ex the right to the bonus, and the price was marked down to 20s. in consequence. The new 10 per cent. preference shares are now 21s. 3d., at which they look a good purchase. It is, indeed, only for this class of share that the investor is at present showing any partiality. Ordinary shares are out of favour, and, with the dividend outlook so much obscured by the labour troubles, it is not surprising that the buyer prefers to stick to fixed-interest securities, rather than to adventure into the more speculative ordinary.

Amongst manufacturing shares, British Aluminiums at 15s. 9d. and General Electric preference at 16s. 6d. are both 6d. down. The General Electric Company's 6½ per cent. "A" preference and 7½ per cent. "B" preference are now both quoted at the same figure. The new debenture is 89½ for the fully paid and 3½ discount for the scrip. Electric Constructions at 16s. 3d. have lost 1/16. Telegraph Constructions remain at 20½. Engineering shares are steady, Babcock & Wilcox holding its rise at 2½. Iron, coal and steel shares are dull, rather than flat. Vickers have gone back to 12s. 9d. sellers, and the 5 per cent. tax-free preference to the same figure. Private advices from the provinces to London business houses hold out no particular hope of immediate settlement of the coal strike, but, in the City, the view is general that the present position leaves the Miners' Executive in a situation as difficult as it is delicate, and one which calls for extremely diplomatic handling if the trades union officials are to retain their power over the workers. Should they, the leaders, fail to do this, the theory is that it will be a good thing for stocks and shares in all industrial companies, as affording evidence that the tyranny of trade unionism may be weakened, and men left at liberty to work as they please.

The feature in the foreign list is a fall of 2½ points in Brazil Tractions, but Anglo-Argentine Tramways are dull also. The second preference at 2½ are ex the 5s. 6d. just paid on account of arrears. Mexican Light & Power first mortgage bonds have fallen 4 to 70½, owing to the disappointment felt at the lack of settlement news from Mexico. There is some grumbling on the part of holders of Mexican Utility bonds at the statement that Income Tax at the rate of 6s. in the £ is to be deducted from the payment of such arrears of interest as are to be distributed early next month.

There is no change at all in the list of home electricity shares. Occasionally a few come to market, but are readily taken. Gas stocks, however, are dull, in consequence of the coal strike, though this particular cause has not yet affected prices in the electricity market. A few Bournemouth & Poole second preference have been changing hands on the basis of 6 1/16. Metropolitan Electric new 7½ per cent. extension debenture stock, issued at 95, continue steady at 98, the partly-paid scrip being 3½ premium. Victoria Falls preference are unchanged at 15s. 9d. and the ordinary at 7s. 6d., although the report is satisfactory, and the ordinary again receive 5 per cent. dividend. Rubber shares are flat upon undisguised fears that many companies must be running short of money; the weakness of the price of the raw material offers no encouragement to the usual supporters of the share market.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price June 21, 1921.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	5¾	—	10 6 6
do. do. do. 4½ Pref.	4½	4½	3	—	7 10 6
Chelsea	4	6	3½	—	9 4 6
City of London	13	14	1⅛	—	11 16 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	8	8	5½	—	9 17 0
do. do. 6 per cent. Pref.	6	6	5¼	—	7 7 8
Kensington Ordinary	7	9	4¼	—	10 18 2
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2⅞	—	10 18 2
Metropolitan	6	7	3¼	—	10 0 0
do. 4½ per cent. Pref.	4½	4½	2⅛	—	7 18 2
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	2¼	—	9 2 10
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	6½	—	9 10 6
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	88½	—	7 3 9
do. Def.	1½	1½	17⅛	—	8 11 6
Chile Telephone	6	6	5⅝	—	5 6 8
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16⅜	—	6 0 4
Eastern Tel. Ord.	10	10	167½	—	5 19 5
Globe Tel. and T. Ord.	10	10	166	—	6 0 4
do. do. Pref.	6	6	9½	—	6 9 9
Great Northern Tel.	22	24	258	—	8 11 6
Indo-European	10	10	85	—	7 2 10
Marconi	25	25	2½	—	—
Oriental Telephone Ord.	12	12	2⅛	—	*5 18 0
United R. Plate Tel.	8	8	5½	—	6 13 4
West India and Panama	Nil	Nil	¾	—	Nil.
Western Telegraph	10	10	16⅜	— ¼	*6 0 4
HOME RAILS.					
Central London Ord. Assented	4	4	48½	+3	8 15 10
Metropolitan	1½	1½	26	— ½	6 17 8
do. District	Nil	Nil	18½	—1½	Nil
Underground Electric Ordinary	Nil	Nil	2¼	— ¼	Nil
do. do. "A"	Nil	Nil	7/-	—6d.	Nil
do. do. Income	4	2	80½	—	2 9 4
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	6½	12½	9¾	— ⅛	10 0 0
do. do. 2nd Pref.	Nil	5½	2½	—	9 11 4
do. do. 5 % Deb.	5	5	65½	—1	7 12 8
Brazil Tractions	Nil	Nil	33½	—2	Nil
British Columbia Elec. Rly. Pfce.	5	5	56	—	8 18 6
do. do. Preferred	5	5	58½	—	*8 15 0
do. do. Deferred	3	3	51½	—	*11 17 6
do. do. Deb.	4½	4½	69	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	52	—	Nil
do. 6 per cent. Bonds	Nil	Nil	29½	—	Nil
Mexican Light Common	Nil	Nil	11½	—	Nil
do. Pref.	Nil	Nil	18½	—	Nil
do. 1st Bonds	Nil	Nil	70½	—4	Nil
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	2⅜	—	6 14 6
British Aluminium Ord.	10	10	15/9	—6d.	12 14 0
British Insulated Ord.	15	10	1⅛	—	9 12 0
Callenders	15	15	1½	—	10 0 0
" 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	16/3	—	12 6
Edison-Swan	10	10	11/3	—	—
do. do. 5 per cent. Deb.	5	5	70	—	7 2 10
Electric Construction	10	10	16/3	— ⅛	12 6 9
English Electric	8	8	12/-	—	13 6 8
Do. Pref.	6	6	14/6	—	8 5 6
Gen. Elec. Pref.	6½	6½	16/6	—6d.	7 17 7
do. Ord.	10	10	1⅛	—	*9 8 2
Henley	15	15	1½	—	10 18 2
do. 4½ Pref.	4½	4½	6¼	—	6 18 6
India-Rubber	10	10	⅛	—	—
Met.-Vickers Pref.	8	8	1⅛	—	8 16 10
Siemens Ord.	10	10	1	—	*10 0 0
Telegraph Con.	20	20	20½	—	*5 17 0

* Dividends paid free of Income Tax.

THE RELATIONSHIP BETWEEN EFFICIENCY AND WORKING COSTS OF SMALL MOTORS AND GENERATORS.

By E. G. KENNARD, A.M.I.E.E.

(*Conc'uded from page* 773).

The improvement due to increase of rated speed is illustrated by the curve in fig. 4 for 5-kW d.c. shunt-wound machines, where the efficiency is seen to increase from 83 per cent. at 250 r.p.m. to 92 per cent. at 2,000 r.p.m., representing a reduction in power at full load of 0·45 kW.

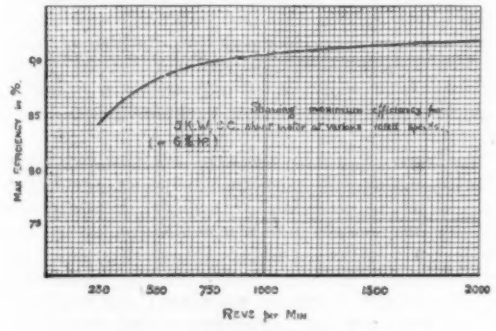

FIG. 4.—EFFICIENCY AND SPEED.

In order to establish a reliable basis on which to estimate the total working costs, it becomes necessary to divide machines into three different classes :—

(*a*) Those for intermittent working, such as lifts, &c.

(*b*) Those running all day on a variable load, driving machine tools, &c.

(*c*) Those running continuously on a steady load, charging accumulators, driving fans, pumping plant, &c.

In class (*a*) where the total number of running hours per year is not large, high efficiency is not important, especially if the price of the motor is increased thereby.

In class (*b*) small no-load losses, and high efficiency at $\frac{3}{4}$ load, are essential to obtain low working costs.

Those in class (*c*) require the maximum efficiency at the normal working load.

As an estimate of the total number of hours per annum worked by motors in (*b*) and (*c*) classes, a fair value will be obtained taking 48 hours per week and 50 weeks per year, giving a total of 2,400 hours per annum.

The following simple formula is then obtained :—

Running costs per year in £ = kW input × 2,400 hours × pence per unit/240.

Running costs per year in £ = kW input × pence per unit × 10.

When estimating the running costs for machines working with a variable load, it is convenient to assume that the average load for the year is one-half the full rated load ; the kW input will, therefore, be approximately—

No load kW input + full load kW input/2.

Having established what is claimed to be a reasonable basis on which to estimate the running costs of electrical machinery, in order to estimate the standing costs or capital charges some figures based on representative prices are necessary before total working costs can be prepared.

Taking the average of present-day prices of British manufacturers, the prices of new machines may be taken as approximately 200 per cent. greater than the pre-war values.

In accordance with the foregoing, the curves shown in fig. 5 have been prepared, showing prices for d.c. machines of standard make at various speeds and outputs. A machine specially built to obtain higher values of efficiency will cost more than the price shown in fig. 5, and these have been estimated to cost some 20 per cent. more. The most striking feature concerning the values shown in fig. 5 is the economy in first cost it is possible to effect by the use of high speeds. For example, the prices of a standard 3·75-kW machine (or 5-h.p. motor rating) are £116, £74, and £48, at speeds of 500, 1,000 and 2,000 r.p.m. respectively, and the ratio of prices for other outputs are approximately in the same proportion.

With regard to the question of standing charges, these cannot be estimated so accurately as the running costs. Prices of machines are unstable, likewise rates of interest on capital, also the question of the annual sum to be charged for depreciation is a debatable one. This amount should cover the cost of running repairs, and also provide for replacement when the machine is obsolete. The present bank rate of interest is 6½ per cent. per annum, the cost of repairs should not exceed 3½ per cent. per annum, and allowing for the scrap value of a machine, 5 per cent. per annum should cover the cost of depreciation. These costs added together make a total annual charge of 15 per cent. of the capital outlay, enabling the annual capital charge for any particular rating to be determined from the prices shown in fig. 5. In the case of high-efficiency machines, as shown previously, when rated in agreement with the Engineering Standards Association's rules, full load occurs at from 25 per cent. to 50 per cent. above the point of maximum efficiency according to the rated speed. It will be seen from the curves in fig. 1 that the drop in efficiency from $\frac{3}{4}$ to full load only amounts to some 2 per cent., so that if advantage is taken of the increased rating, the high-efficiency machines will cost no more than standard ones at the lower temperature rating. As an alternative, high-efficiency machines may be employed with the full-load rating at their maximum efficiency, the capital costs then being increased by some 20 per cent., this course being justified in some cases where long running periods are necessary. It is evident that in cases where increased efficiency incurs a corresponding increase in capital charges, it will be important to take into consideration the number of hours the machine will be in use ; if the choice lies between, first, a motor of high efficiency and high first cost ; and, secondly, a motor of low efficiency and low first cost, then the number of working hours per annum at which both machines will have the same working

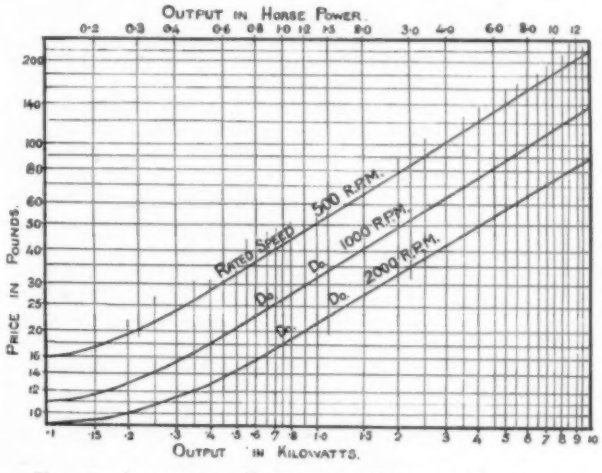

FIG. 5.—APPROXIMATE PRESENT-DAY PRICES OF STANDARD CONTINUOUS CURRENT MACHINES.

costs (*i.e.*, current costs and capital charges), may be determined by the following formula :—

Number of hours = difference of capital charges in pence per year / difference of current costs in pence per hour.

For example, suppose it is required to select a 5-h.p. motor (1,000 r.p.m.) to run for approximately 500 hours per annum from mains where the cost of current is 3d. per unit. One motor has a guaranteed efficiency of 78 per cent., and is priced at £75, and the other 85 per cent., and priced at £80.

At 15 per cent. per annum the capital charges for each motor are 2,700 and 2,880 pence respectively. At 3d. per unit the costs for current for each motor are 14·3 and 13·15d. per hour.

Then the number of hours per annum for equal cost
$= (2{,}880 - 2{,}700)/(14{\cdot}3 - 13{\cdot}15) = 137$ hours,
and as it is required to use the motor for 500 hours, it will be more economical to install the efficient motor at a higher

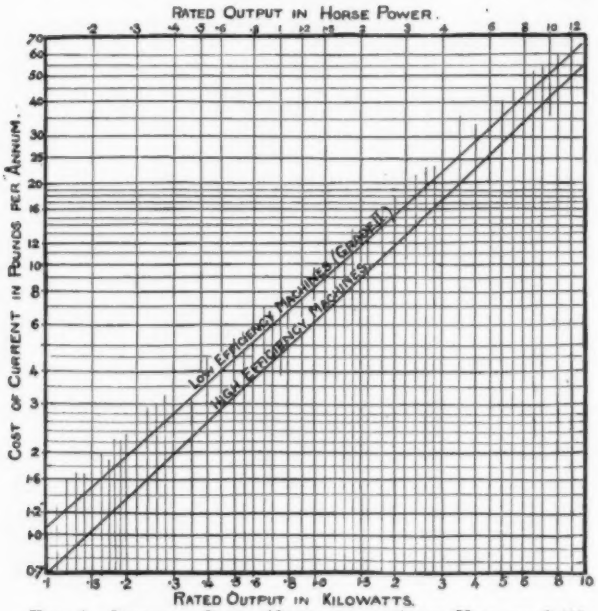
Rated Output in Horse Power.
Cost of Current in Pounds per Annum.
Low Efficiency Machines (Grade II).
High Efficiency Machines.
Rated Output in Kilowatts.

Fig. 6.—Running Costs (Current only) per Year of 2,400 Hours for Machines Working on Variable Load Based on Current per Unit, and an Average between Light and Full Load.

first cost. This formula may be applied to any machine under the class (*a*) heading, where the number of hours is approximately known. For motors working under a variable load, machines having their maximum efficiency at ¾ load should be used wherever possible, as not only are capital costs reduced, but at light loads the efficiency curve is considerably higher. Estimating the average load on a machine working at a variable output to be one-half of its full rated load, then the fall in efficiency due to variable load conditions is 2¼ per cent. in the first case, to 5¼ in the second case (values obtained from curves in fig. 1).

Curves have been prepared in fig. 6 showing the total cost of current per year for high and low-efficiency machines working at a mean load of one-half the rated full load, the number of hours being taken at 2,400.

As the curves show the costs at 1d. per kW-hour, at other rates for power the cost is obtained as a direct multiple of these values. From fig. 6 it will be found that the saving per annum varies from £0·5 for a ¼-h.p. motor to £10 for a 12-h.p. motor where a h.e. machine is used in place of a l.e. one. As the present price of power averages 3d. per unit, for the average power user these figures may be increased threefold.

Returning now to motors in class (*c*), where machines are run at a constant load, in most cases it will be preferable to employ a machine loaded at its maximum efficiency; this will avoid the practice of always running at high temperature, and also leave a margin for overloads. Where machines designed for high efficiency are employed, it will occasion an extra capital charge as compared with standard-type machines, and these costs are estimated to be some 20 per cent. greater. It is, therefore, necessary to take capital charges into account in estimating possible economies for class (*c*) machines.

On the 15 per cent. per annum basis these charges vary (for a standard motor at 1,000 r.p.m.) from £1·75 for a ¼-h.p. motor, to £21 for a 12-h.p. motor.

Where the motors are in use for the normal period of 2,400 hours per year, these charges expressed in pence per unit consumed by the motor would be ·55d. for the ¼ h.p., and ·175d. for the 12 h.p., indicating that the capital charges are not a large percentage of the total working cost at prevailing prices for electricity supply. In fig. 7 two curves are drawn representing the total working costs for high- and low-efficiency (Grade II) machines working at full load for a working period of 2,400 hours per year, and on a basis of current at 3d. per kW-hour. Although the h.e. machines are debited with 20 per cent. increase on capital charges a considerable yearly saving is obtainable by their use.

For a small rated output of 0·2 kW (or ¼ h.p.), a saving of £1·8 per annum could be effected, and for a 10-kW (or 13 h.p.), a saving of £48 per annum. There are, of course, many motors in use with higher efficiency values than the Grade II machines, but even taking machines classed under Grade I approximately one-half of the above values would be obtained.

Having shown the economical possibilities of single machines of higher efficiency, it is evident that the question of efficiency is of still greater importance in connection with the motor-generator, where a double source of loss exists.

Various forms of motor-generators are now very largely used for a variety of purposes including accumulator charging, kinema projection arc lamps, electro-plating, electric welding, conversion of a.c. to d.c., &c.

In addition to motor-generators for accomplishing these purposes, there are (*a*) rotary converters; (*b*) auto-motor-generators or series connected machines; and (*c*) double-wound armatures for d.c. (sometimes called dynamotors). It is surprising to find the somewhat limited extent to which these more efficient types of machines are employed for conversion purposes.

The main objection to the use of (*a*) and (*c*) type machines is on the ground of restricted voltage control, although for many uses this is not highly important. Series connected motor-generators are to be recommended for stepping-down direct-current voltages where the ratio of conversion does not exceed 4 to 1, and where a certain amount of voltage regulation is required. This method has been employed to a small extent for kinema projection arcs, stepping down from 220 V to 70 V, and this arrangement might also be applicable to battery charging. It is

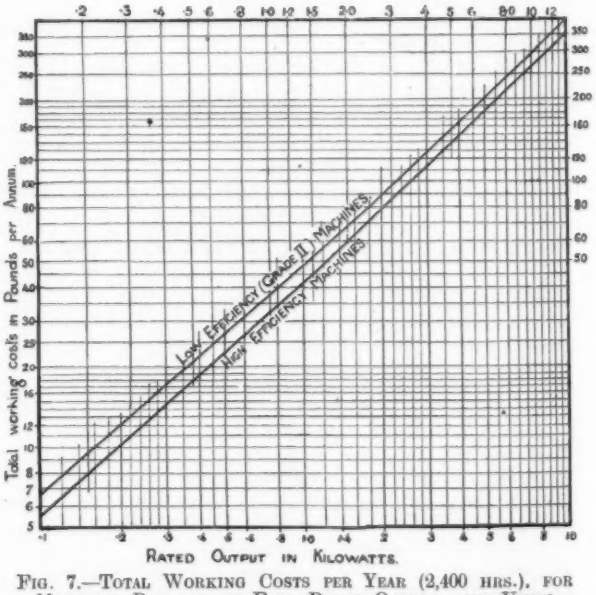
Total working costs in Pounds per Annum.
Low Efficiency (Grade II.) Machines.
High Efficiency Machines.
Rated Output in Kilowatts.

Fig. 7.—Total Working Costs per Year (2,400 hrs.), for Machines Running at Full Rated Output, and Using Current at 3d. per Unit.

especially suitable for a reduction of the voltage in the ratio of 2 to 1, as would be required for charging a 44-cell automobile battery from a 200-V main. Suppose that the charging rate be 2 kW, the cost of charging will be approximately the same whether charging direct from the main with a series resistance, or using an ordinary Grade II motor-generator. The following formula is useful for determining the proportion of generator output to total

secondary output where series-connected machines are used—

$$D = T/(1 + 1/R\,E).$$

Where D = dynamo output in watts.
T = total watts output required from secondary circuit.
R = ratio, motor volts ÷ dynamo volts.
E = overall efficiency of set.

Applying this formula to the case suggested above—

$$D = 2{,}000/(1 + 1/{\cdot}74) = 850 \text{ watts},$$

E being based on the combined efficiency of two h.e. machines at 2,000 r.p.m. (approx. 86 per cent. each).

Total watts from 200-V main = 2,300.

Overall efficiency is approximately 86 per cent., whereas charging from the main through a resistance would only yield 50 per cent. overall efficiency.

Allowing the capital charges at £7·2 and £1, the following annual costs at 3d. per unit (2,400 hours) are obtained :—

Series connected motor-generator, £77·2
Direct from mains through resistance, £121,

resulting in a net saving of £44 per annum.

The advantages of moderately high speeds have already been referred to, allowing both a gain in efficiency and a reduction in capital costs. For many commercial uses, speeds above 1,000 r.p.m. cannot be profitably employed for motor driving, owing to the difficulty of arranging suitable couplings without employing reduction gear.

Where motor-generators are concerned, however, full advantage can be taken of high speeds, although at present even for small machines below 1 kW output, 1,000 r.p.m. appears to be the standard speed. In fig. 8 curves have been prepared showing the working costs per annum for various types of motor-generators on the basis of current at 3d. per unit.

Some remarkable reductions are noticeable between the working costs for Grade II machines at 1,000 r.p.m., and h.e. machines at 2,000 r.p.m. (Curves A and B).

For example, for the smallest type of machine of 100-watts output, as commonly employed for charging automobile ignition accumulators, the cost per annum falls from £12·6 to £8. Then taking a somewhat larger machine of 1 kW output as might be used for plating purposes, the annual

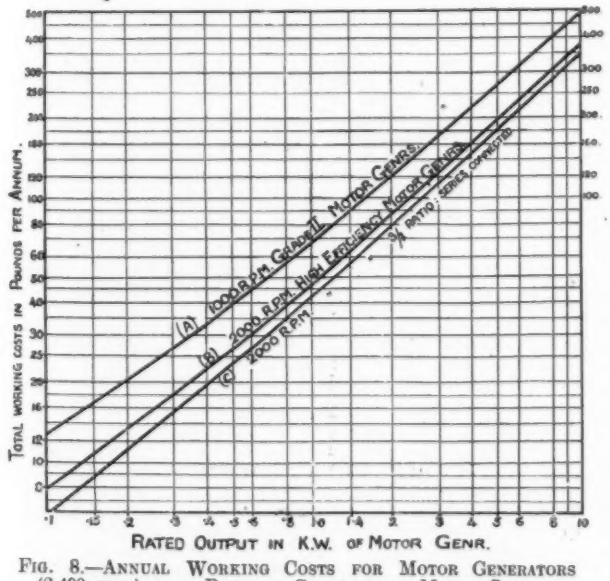
Total working costs in Pounds per Annum.
(A) 1000 R.P.M. Grade II. Motor Genrs.
(B) 2000 R.P.M. High Efficiency Motor Genrs.
(C) 2000 R.P.M.
3/1 ratio: series connected.
Rated Output in K.W. of Motor Genr.

Fig. 8.—Annual Working Costs for Motor Generators (2,400 hrs.) on a Basis of Current for Motor Side at 3d. per Unit.

costs fall from £68 to £46. Lastly, noting the values for a machine of 10 kW output, the annual working cost falls from £500 to £385.

If in the latter case where, for example, the motor-generator is required for welding purposes, the voltage ratio is approximately 3/1, then a further reduction to £300 could be obtained by using a series connected machine.

In fig. 9 some curves are drawn showing the actual cost of current at the generator terminals after the capital costs have been met, and the losses in the machines paid for; these are based on power current to the motor terminals being obtained at the uniform rate of 3d. per unit.

It would no doubt be surprising to many users of motor-generators to know that the actual cost of their regenerated current was two or three times the initial cost of the power,

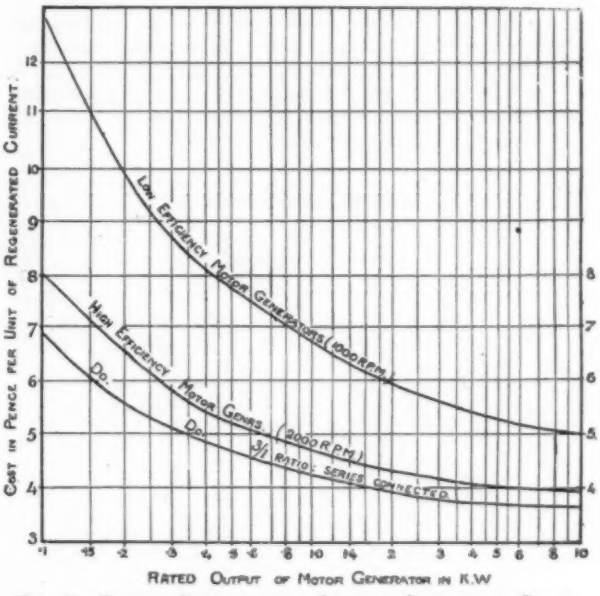
Cost in Pence per Unit of Regenerated Current.
Low Efficiency Motor Generators (1000 R.P.M.)
High Efficiency Motor Genrs. (2000 R.P.M.)
Do.
Do. 3/1 ratio: series connected.
Rated Output of Motor Generator in K.W.

Fig. 9.—Curves Showing the Cost of Current in Pence per Unit from the Secondary Side of a Motor Generator, the Price of Power Current to the Primary Side being 3d. per Unit.

and for the small 100-watt charging machine, over four times the initial cost.

These curves also illustrate the advantage of using machines of higher efficiency, the difference between the two curves being very marked.

It has been found necessary to limit the scope of this investigation to direct-current machines, but some data relating to standard a.c. machines are given in Table II, and may be cited as indicating the direction in which a choice of machines for economical working may be looked for. The particulars given in this table relate to machines of 5 h.p., 50 ~ and 1,400 r.p.m.

TABLE II.

Type of motor.	Full load efficiency.	Approx. prices.
Induction, three-phase, sq. cage ...	86 %	£70
Induction, three-phase, wound rotor	84 %	£80
Induction, one-phase, sq. cage ...	81 %	£88
Induction, one-phase, wound rotor	79 %	£100
Repulsion, one-phase	75 %	£130

It is seen from this table that three-phase are preferable to single-phase motors, and that squirrel-cage rotors are more efficient than wound rotors. Wound rotors should only be employed where starting-current and torque conditions necessitate their use, and the repulsion-type motor where starting against considerable load is required.

For motor-generator work the squirrel-cage induction motor should meet most requirements.

In concluding this article it is pointed out that in many cases hard and fast rules cannot be adhered to in effecting a reduction of working costs, and a careful study of the following points is necessary before a decision can be arrived at :—

(*a*) Extent and nature of load.
(*b*) Number of working hours per annum.
(*c*) Purchase price of machine.
(*d*) Maker's guaranteed efficiency curve.
(*e*) Cost of current in district where machine is to be installed.

However, certain facts have been established which should prove of use when laying out plant to the best economical advantage, and these are summarised below:—

1. An increase in rating of machines at present in stock up to the 90° F. limit (in accordance with the Engineering

Standards Association's decision such temperatures can be safely employed) would generally result in improved "all-day" efficiency.

2. An increase in the first cost of a machine in many cases will be justified to obtain higher efficiency.

3. High speeds up to reasonable working limits should be employed where driving conditions do not prohibit their use.

4. The use of series-connected motor-generators offers considerable reductions in working costs where the ratios between primary and secondary voltages are favourable.

5. Low-efficiency machines are best suited for operations in districts where the price of power is low, or where the number of working hours per year is small.

REVIEWS.

Ozone. By E. K. RIDEAL, M.B.E., M.A., Ph.D. Pp. viii+198; 24 figs. London: Constable & Co., Ltd. 1920. Price 12s. net.

This book forms the second published section of the late Mr. B. Blount's "Treatise of Electro-Chemistry," which is intended to comprise a comprehensive series of separate monographs based on the chapters of Mr. Blount's well-known text-book. The scheme is an ambitious one, but it was worth the attempt, and it deserves success.

The present book is by one of our younger electrochemists, a gifted and promising investigator, from whom much is expected. It is gratifying that the attractions of a professorship at the University of Illinois were not proof against the call of his native land, and Dr. Rideal is now teaching electrochemistry at Cambridge, where we hope he will found a vigorous school of that branch of physical chemistry. Dr. Rideal has exceptional gifts as an expounder, not the least of which are his lucidity of style and his grasp of fundamentals, and his talent for teaching finds a ready outlet in the volume before us. The book, however, is not, in our view, well balanced. While no doubt ozone is in itself a substance of considerable interest, whether from the chemical point of view as an allotrope of oxygen, or from the electrical point of view as an accompaniment of many types of discharge, nevertheless its chief claim to general attention lies in its remarkable properties as an oxidising agent—in other words, in its industrial applications—and yet to these the author devotes only about one-fifth, just one chapter, of his book. We are far from underrating the importance of what appears to be purely academic discussion, but we do feel that if some of the space devoted to the consideration of theoretical methods of producing ozone, such as thermal or electrolytic methods, had been devoted to a fuller and more critical account of its use or possibilities, say, in the oil, fat, and wax industries, or in organic chemistry generally, the book, excellent as it is, would have been far more helpful and stimulating.

The electrical engineer, as such, will find Chapter VII the most interesting in the book, as it deals with the formation of ozone by the action of the silent discharge in air—at present the only method of manufacture that has attained technical importance, although the quartz mercury-vapour lamp ozoniser has possibilities worthy of scrutiny. The theoretical discussion in this chapter is well handled, and the conditions favourable to maximum production are brought out with precision and clearness. The accounts of the various ozonisers in use, however, are descriptive on the whole rather than critical. Possibly there do not exist sufficient quantitative data on which to base a critical discussion. There is much scope for further experimental study of the industrial preparation of ozone.

In the field of application the most extensive use of ozone at present is for the sterilisation of water. We are told that over fifty sets of plant are in operation for this purpose; but while ozone may perhaps continue to be used in certain cases for completing the sterilising process, it is likely that electrolytic hypochlorite or chlorine—far cheaper products—are destined to replace ozone in course of time.

Of great interest is the discussion of the *rationale* of air-purification by means of ozone, a process which must be assumed to be beneficial in view of its extending use on the London tube railways and elsewhere, but which nevertheless is at present difficult to explain in a satisfactory manner. We can hardly accept the view sometimes put forward that the effect is purely psychological, but yet no evidence exists that the small quantities of ozone used can be germicidal—except in the air which actually passes through the ozoniser.

It is clear that the remarkable properties and the future possibilities of ozone give it an interest quite out of proportion to its actual importance.

Dr. Rideal's book will, therefore, make a strong appeal to those whose imagination is stimulated by the promise of what may be, rather than by the more prosaic performance of what actually is.

An Introduction to Technical Electricity. By S. G. STARLING, B.Sc., A.R.C.Sc. Pp. 181; figs. 158. London: MacMillan & Co., Ltd. Price 3s. 6d. net.

The publishers' note at the beginning of this work points out that the Education Act of 1918 will call for a large extension of elementary school work, and their Life and Work Series is meant to supply this demand. The volume on technical electricity by Mr. Starling has been specially written with a view to treating the subject in a manner suitable for young students. It is clearly written, and the subject matter is likely to make a very direct appeal to all readers. Since the book is primarily for class work many simple illustrative experiments are described, and there are several test questions at the end of each chapter. The book could be read without much difficulty by a private student, although a fair knowledge of chemistry and some elementary algebra are presupposed. It would add to the value of the book if a price list of the instruments and materials for the experiments were given, as many keen students are prevented by local circumstances or by temperament from attending organised courses. The scope of the book includes Electric Circuits, Ohm's law, Primary and Secondary Cells, Induced Currents, and these subjects are illustrated in a very practical way. The only criticism which the reviewer has to offer is that the machines shown in the figures are completely out of date and can now be found only in museums. The Elihu Thomson supply meter shown in fig. 149 has no potential resistance other than that of the armature, and although this may be rather beyond the scope of the readers, it is an error, and should be corrected. It would be better to describe a mercury motor meter as this type is far commoner in Britain than the commutator type. On the whole the book is very good, and can confidently be recommended.

Elementary Telegraphy. By H. W. PENDRY. Second edition. Pp. 237; 189 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

This book, written especially to meet the requirements of the first grade of the subject in the syllabus of the City and Guilds Institute, can be recommended confidently as a first text book in the art and science of telegraphy. In the ten years which have elapsed since the first appearance of the book there have been various advances in practice, and these the author takes into account—so far as they fall within the province of the book—by describing later apparatus and including new and revised diagrams. As the book is intended primarily for students a feature which will be generally appreciated is the appending of exercises to each chapter and the inclusion of the City and Guilds examination questions for the years 1908-1920 inclusive. It cannot be emphasised too strongly that the solution of definite problems is the best means of testing and establishing knowledge. A welcome addition from the reader's point of view would be the inclusion of answers to all the numerical problems.

Commencing with an introductory treatment of the fundamental principles of electricity and magnetism, particularly as bearing upon telegraphy, the author proceeds to deal with primary batteries and secondary cells as used in telegraphy. Telegraph instruments are then described, attention being confined to the simpler equipment, all of which is well illustrated by photographs, by diagrams where necessary, and by connection diagrams in every case. Telegraph lines, overhead and underground, are next considered, all the main constructional components being described and illustrated and good practical treatment being given to the main principles of erection and operation. Testing instruments and the simpler line tests are also considered in this chapter.

The simpler systems of manual telegraphy, duplex working, central and universal battery systems, and various developments in this field are discussed in Chapter V, whilst the final chapter contains useful miscellaneous information on earth currents, and the protection of line and apparatus.

The general verdict on this book will be that it is a volume with a definite purpose which is very well fulfilled.

Telegraphy. By T. E. HERBERT. Fourth edition, revised. 1,019 pages; 638 figures. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

In reviewing this monumental work, long since familiar to every telegraph engineer, it is unnecessary to do more than notice the additions to the text in the new edition. In general, the work remains the finest and most comprehensive treatment available for the telegraph engineer, dealing as it does with the fundamental principles of magnetism and electricity; primary and secondary cells; circuit laws and calculations; current, voltage and resistance measurements; all the apparatus and circuits employed in various telegraph systems; and the construction and testing of overhead and underground lines.

Several pages describing the Kleinschmidt keyboard perforator have been added to Chapter X on the Wheatstone automatic system. Chapter XVII on secondary cells has been overhauled, some additional information being incorporated. The chemistry and physical phenomena of the action are considered, plate and cell constructions are described at

considerable length, and very sound recommendations are made concerning the treatment of cells.

Appendix C, dealing with the Gulstad relay, has been re-written with the incorporation of much information of special interest now that the G-relay is adopted on so many long and difficult circuits. The G-relay has been, of course, the P.O. standard relay with the addition of auxiliary windings employing the Gulstad principle. The vibrating relay increases the working margin on long high-speed Wheatstone circuits and increases the rate of transmission on some of the long underground and submarine cables by 50 per cent. The use of G-relays on the London-Newcastle quadruple duplex Baudot line (358 miles, KR=103,700) has dispensed with the repeater formerly required at Warrington.

Though amplifying valves are not yet employed on telegraph circuits in this country, there can be no doubt that their remarkable properties will soon be utilised. The author has, therefore, wisely gone ahead of present practice in this country and provided in the addendum a very useful treatment of the thermionic relay—its principle, construction and application.

No great success has yet been obtained in evolving formulæ which will enable the working speed of a cable circuit to be calculated directly. There are many factors which cannot well be taken into account mathematically, hence the actual speed is lower than that indicated by formulæ, and the only safe practice is to base estimates upon the rate of working in circuits of similar construction but different length. In aerial lines the determining factor is the value of the received current, and the author gives an excellent *réaumé* of J. L. Taylor's researches in this field. Atmospheric conditions in this country make the loss of current due to low insulation the limiting factor determining the permissible length of overhead telegraph wires.

The addendum concludes with a description of the vibroplex and an unbiased estimate as to its value in preventing telegraphist's cramp. The device, which is used considerably in America, consists of a lever which is moved to the left to send a dash, and which is held over to the right for varying periods, whilst the requisite number of dots is sent automatically by the vibration of a weighted spring. It is a question whether telegraphist's cramp is not due generally to faulty technique on the part of the operator, and whether the risk of cramp cannot be virtually eliminated by the use of double current keys instead of single current keys on busy circuits.

In conclusion, it may be asserted that this volume remains the classic work on telegraphy both for engineers in practice and for students, who will be interested to know that the book is recommended by the C. & G. examiners.

RECENT DEVELOPMENTS IN TURBINE PRACTICE.

DISCUSSION AT NEWCASTLE-ON-TYNE.

MR. K. BAUMANN'S paper on the above subject, which was abstracted in our issues of April 15th and 22nd, was discussed by members of the North-Eastern Centre of the Institution of Electrical Engineers on May 9th.

Mr. F. W. GARDNER, in opening the discussion, characterised the paper as essentially controversial, saying that many of the conclusions arrived at must on that account be open to question. The point of primary interest was its bearing on the old controversy which still raged round the relative merits of the two great types of turbine, *i.e.*, impulse and reaction. The next point was the author's dislike for the tandem turbine. At the outset he belittled the performance of tandems with a two-flow exhaust by ruthlessly dividing the output by two, although the fundamental virtue of a tandem machine was its adaptability for the two-flow arrangement. The speaker referred to the tandem as a means of increasing the output at a given speed beyond the maximum attainable efficiently with a single cylinder. The alternative was the multi-exhaust described in the paper. That, he suggested, added appreciably to the length, weight, and complexity of the turbine and, therefore, to its cost. The paper contained no evidence to show that a multi-exhaust could be as effective as a two-flow tandem machine in keeping down leaving losses. The blade height that could be used with a given mean diameter and stress was greater in the tandem, as the complication of an abrupt change of section half-way up the blade was not required. Further, the multi-exhaust necessitated the introduction of a labyrinth of idle blades and guide passages, the losses in which must be considerable. The multi-exhaust undoubtedly marked an advance upon a single exhaust, but some more concrete evidence of its actual performance was required before they could share the author's optimism about its efficiency. The paper showed that a given area through the last row was best obtained by adopting a tall blade on a small disk—that was, by making the ratio of blade height over diameter as large as possible; and in that respect the reaction turbine had an advantage over the impulse type, because the limiting value of that ratio depended, finally, on the possibility of providing against blade vibration rather than on the theoretical value of the stress in the material. Vibration was most effectively prevented by binding the blades together at frequent intervals along their length, and that could be done without appreciable loss of efficiency in reaction blades, as the velocity of the steam at the inlet edge was comparatively low with that type. Also the spread of the blades at the tips could be made greater with reaction blading without serious loss of efficiency. There was another reason why a tandem arrangement was advantageous. The practice of reheating the steam at the stage where the initial superheat disappeared was developing, and might very soon be widely adopted for large plant. In that case, the whole of the steam had to be withdrawn from the turbine and then returned for the remainder of the expansion, and the turbine, therefore, automatically became a two-cylinder machine. The same applied in a lesser degree where steam was bled from the turbine at two or more points for heating the boiler-feed water, as it seemed improbable that all the necessary belts for steam extraction and also a multi-exhaust could be crowded into the span of a single shaft, at all events if the exhaust were of the more complicated type foreshadowed in the description. The section of the paper dealing with the correction factors which had to be applied to reduce the actual steam conditions of a test to the design standards had been very carefully and thoroughly worked out. A comparison of the new curve given for the vacuum correction with that given in the author's earlier paper showed clearly how the leaving losses had increased in importance with the increase in the size of turbo-alternators. Such curves had been in use by designers for a long time, but had not, he thought, previously been published, and the author's new curve should be of much service for general purposes, though in supplying correction charts for large plant the manufacturer would prefer to treat each case individually, since the curve was applicable only to plant rated strictly in accordance with the author's definition of economic rating, and it was hardly possible to include all the widely differing cases occurring in practice accurately in a single curve.

Mr. T. WAITE was not very much concerned about the question of impulse or reaction turbines referred to by the last speaker, but was more interested in the matter of breakdown. The matter of maximum size of the turbine depended largely, to his mind, upon the kind of system to be used. Despite all the technical skill used, breakdowns did occur and, so far as electrical undertakings were concerned, the first point was reliability, and that being so the maximum size of any turbine should be just such as, in the case of broakdown, would permit of the load being carried within the capacity of the remaining plant. He agreed with the author that the factor of safety should be increased with the size of the turbine, and favoured the figure of 15 per cent., for their experience was that 10 per cent. did not provide a sufficient margin. With regard to the author's remarks on the by-passing of steam, he pointed out that the turbine was not designed to run on overload long, and those who permitted this were not looking after their business well.

Mr. DOWSON drew attention to the fact that it had always been the policy to aim at reliability first, and after that economy. When the author read his former paper in 1912 they were thought to be falling away because they were below the speed figures given. In 1915 their maximum surface speed was 500 ft., while that of the impulse turbine was much higher. They had always used ordinary carbon steel, and one of the features of the Parsons turbine in this country was its simplicity. Regarding the author's remarks on the factor of safety in the large turbine, he did not think anyone could say anything against the reaction design in the way of lowering that factor. That question also brought out that of tandem turbines, which were introduced first as reaction machines, and he thought that the value of that design was quite understood. With regard to the multi-exhaust, which he admitted was very ingenious, he did not quite agree with the justification put forward by the author, because in a given power station they did not necessarily want to install as large a turbine as they could. He thought the better way was to use a higher vacuum, which under present circumstances, should not present any great difficulties.

Electrically-Treated Seed—Mr. A. H. Forder, contractor for the electricity supply for Laura, South Australia, has during the past two years treated seed wheat and oats with electricity for experimental purposes. Mr. H. L. Tomlinson, of Taplan, near Loxton, sowed the electrified seed alongside wheat of the same variety treated in the ordinary way (pickled). Each was given the same chance. In growth right through the electrified seed was superior, and at the finish went 31 bushels to the acre against 27. Mr. Tomlinson considers it would be a good plan to electrify all the seed reaped from the experimental plot, and sow again this year on clean land for the purpose of carrying the experiments further. The grain resulting from the electrically-treated seed seems to be much improved, and is free from smut.—*The Leader*, Melbourne.

A MARCONI WIRELESS TELEPHONE SET FOR AIRCRAFT.

A pamphlet recently published by Messrs. Marconi's Wireless Telegraph Co., Ltd., gives a full description of a combined wireless telephone transmitter and receiver for installation on aircraft for communication to ground stations or other aircraft.

The chief characteristic of the set is that it combines in one box both transmitter and receiver (fig. 1), connected permanently by cables to a small control set (fig. 2). This control unit can be mounted conveniently to the hand of the user, while the set proper can be installed in the most convenient position. A small wind-driven generator supplies all power for transmission, both h.p. at 1,500 V and 0.1 A, for the oscillatory circuits, and l.p. at 7 V and 5 A for the valve filaments of the receiver; a "send-receive" switch is used for changing over. An accumulator floats across the l.p. supply terminals, but does not actually supply power, acting merely as a voltage regulator when the generator varies in speed, and it also helps to smooth out the ripple on the generator commutator. The generator is of unusual design, and consists of two entirely separate machines in one case, driven by a common shaft, the axes of the machines being parallel. The h.p. machine is simply a common type of self-excited d.c. generator. The other machine, with its separate magnetic field, has two commutators, the forward one giving a high-pressure supply. The second commutator gives 7 or 8 V, and is used for the self-excitation of its field windings. By this arrangement the l.p. machine runs continuously, while the h.p. machine can be switched on or off without disturbing the l.p. supply. On transmission, therefore, the l.p. machine power is diverted to the transmitting valve filaments and the h.p. machine is switched on by completing the circuit from its l.p. commutator to its field coils, but on reception the h.p. is switched off and the l.p. machine power diverted to the receiving valve filaments. The design is such that generator noise on reception is negligible. A l.p. smoothing condenser is connected across the l.p. terminals to help eliminate noise.

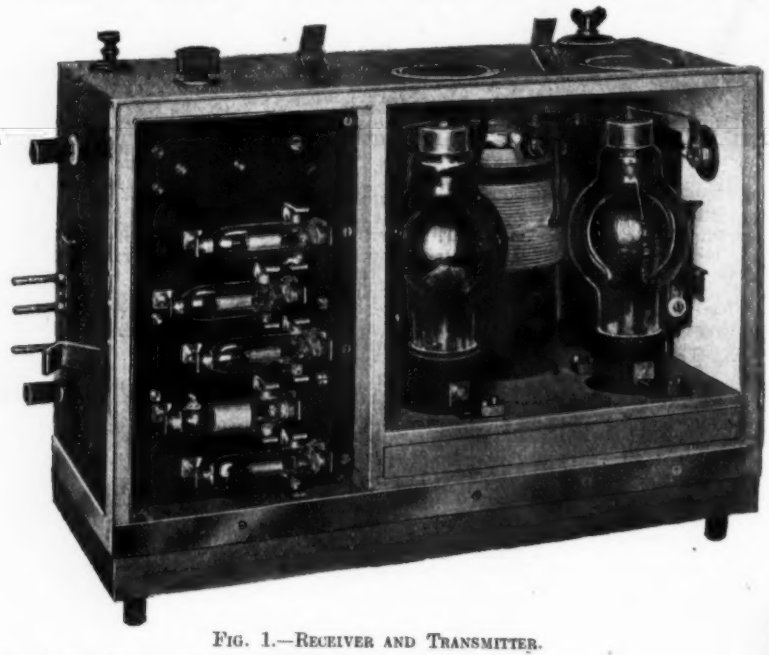

Fig. 1.—Receiver and Transmitter.

Power is fed from the generator by a five-way cable consisting of four wires bunched in an outer aluminium braided covering, the latter forming one of the conductors, to a smoothing condenser. This condenser is connected across the positive h.p. and the negative common earth (the braided covering). The condenser smoothes out the h.p. ripple, and the containing box carries a plug junction for the power feeders. This enables the generator wires to be disconnected quickly from the main wiring of the apparatus if the generator is to be removed from its mounting on the machine.

The power feeders lead on from the smoothing condenser to the remote-control unit, which mounts the send-receive switch and the receiver adjustment. The send-receive switch, which is operated by the central handle, determines whether the power shall be carried to transmitter or receiver. It switches off the h.p. and lights the receiver filaments on reception, or lights the transmitting filaments and applies the h.p. to the transmitting oscillating and control circuits on transmission, and furthermore, appropriately changes over the aerial. The two remaining handles apply to the receiver and control the tuning condenser for adjusting to the correct wave-length and a resistance for cutting down the loudness of the speech when flying near a ground station.

The transmitter consists of the usual oscillatory circuits for the generation of continuous waves and the low frequency control circuits for modulating the intensity of these waves. The former circuits comprise a power valve with reaction and aerial coils. A wave-length switch cuts in or out a certain part of the aerial coil. Thus every set is capable of radiating two wave-lengths; with the standard windings these are 900 metres for the aircraft wave and 600 metres for communication with ships or land stations. The control circuits embody a microphone transformer, choke, and control valve for amplifying the voltage variations of the microphone transformer and superimposing these on the h.p. supply.

The receiver is a five-valve circuit consisting of three high-frequency amplifying valves, one detector valve, and a note magnifier. The valves are lighted from the commutator of the l.p. generator and fed with h.p. power from a battery. The condenser in the control unit gives fine variations of wave-length about a fixed length. When used as an operator-controlled set, however, it is possible to obtain wave-lengths of from 450 to 1,000 metres by the use of an induction tapping switch, which provides a coarse wave-length adjustment, the finer changes being given by the movement of the condenser in the control unit. The aerial circuit is inductively coupled to the first high-frequency valve through a so-called aperiodic coil. This coil, when loosely coupled to the aerial

Fig. 2.—Control Unit.

circuit, has a natural wave-length equal to that of the standard to be worked to. On tightening the couple, however, the mutual inductance of the aerial and aperiodic coil tends to bring in two possible resonance points, one higher and one lower than the wave obtained with loose coupling. Thus, by varying the coarse wave-length switch in combination with the control condenser, the aerial circuit is tuned. The whole of the high-frequency circuits are screened in one metal box and the aperiodic and aerial coils are screened themselves from the high-frequency transformers. Reaction is arranged for so that the set can be made to oscillate and work as an auto-heterodyne circuit for the reception of continuous waves, or can be given increased sensitivity for the reception of weak signals by increasing the reaction.

The high-frequency transformers are damped very heavily so that the reaction adjustment is fully controllable from the appropriate handle, and is not greatly affected by wave-length changes or filament brightness. Low resistance telephones are used connected across the secondary terminals of a step-down iron-core transformer so that there is no danger of demagnetising the telephones by the anode current through the note-magnifying valve. The telegraph unit has a key, buzzer, and switch. In one position the key is arranged to cut up the continuous waves into Morse by opening and closing the grid resistance, and so will give continuous wave transmission. In the second position of the switch a buzzer replaces the microphone, the control valve becomes operative, and an interrupted continuous wave is sent out. A third contact on the switch short-circuits the key and throws the microphone into circuit in place of the buzzer.

To enable the user to hear his own voice above the noise of the engines, and thus correct any tendency to shout, the secondary of the microphone transformer at its "earth" end is connected in series with the telephones of the receiver. This impairs the sensitivity of neither the transmitter nor receiver.

The generator, in cases of emergency, can be run from an accumulator as a motor-generator, but this means additional weight for the machine. The total weight of the apparatus described is 63.5 lb. The largest part of the equipment measures 14.5 in. by 6.75 in. by 10 in. It will be seen from these figures that the whole of the equipment adds but a negligible quantity to the weight carried by the machine in which it is installed.

THE BRITISH SCIENCE GUILD.

THE fifteenth annual meeting of the Guild was held, by kind permission of the Warden and Court of Assistants, in the Goldsmiths' Hall on June 8th.

In presenting the annual report, LORD MONTAGU OF BEAULIEU, K.C.I.E., C.S.I. (president), made reference to the industrial questions still awaiting a solution, and reiterated the oft-expressed opinion that only increased output could restore the nation to a normal basis. To secure this increased production the scientific habit of mind must be inculcated into the minds of workers and masters alike. This would lead to a wider outlook, and lead them to seek the truth. Science aimed at truth. Since the banishment from the Garden of Eden, the success of men in ninety-nine cases out of a hundred, had been due to hard work aided by science; by men working a little harder than their fellows. The speaker sympathised with Lord Robert Cecil's views upon the working of the League of Nations, but he thought the possibility of success in this direction was still far off. To bring about the necessary state of mind education, in which science would play a prominent part, was needed. Science was becoming of more and more importance to the individual as well as to the nation. Turning to the report, Lord Montagu spoke with regret of the loss to science caused by the deaths of Sir Norman Lockyer and Sir William Mather, who had been foremost in furthering the success of the Guild. The work of the Guild during the year was then briefly reviewed.

An important activity during the year had been the preparation of a catalogue of British scientific and technical books. This catalogue was the most comprehensive of its kind in existence, and contained particulars as to the author, title, size, date of last edition, publisher, and price of every volume on science and technology (with the exception of elementary school books) now in publishers' lists. More than six thousand titles had been classified.

The committee had had under consideration the utilisation of science in public departments. It urged that technical and scientific officers should have a status in every way equal to that accorded to the "administrative staff," and that the scale of their salaries should, in order to correspond with the measure of their responsibilities, be raised to the same standard as that of the "administrative staff."

In order to make the work of the Guild more generally known outside London, and to increase its membership and thereby its influence, the interest of the members in the provinces had been enlisted in the establishment of local branches or "groups," which would assist in carrying on the main work of the Guild, and also engage upon local problems. Steps were being taken to establish such groups in Birmingham, Bristol, Cardiff, Dublin, Dundee, Leeds, Leicester, Liverpool, Manchester, and Newport (Mon.).

Meetings of Rotary Clubs had been addressed at Bristol (by Sir Richard Gregory) and at Brighton and Portsmouth (by Mr. J. J. Robinson). Several of them had already joined the Guild, and in others the decision to do so awaited confirmation. A conference between representatives of these clubs and local "groups" of the Guild with the Executive Committee was being arranged for July.

A sub-committee had been appointed to inquire into the position of the manufacture of British laboratory ware, porcelain, filter paper, and microscopes, as regarded supply, cost, and quality, in comparison with imported goods. In December last the representatives of the manufacturers of optical instruments gave evidence to the committee on the position of the British optical industry as affected by German competition.

A conference on "Science and Labour in the Modern State" had been suggested. A meeting was held between the Parliamentary Committee of the Guild and representatives of the Labour Party last July, at which the idea of such a conference was approved; but owing to the disturbed industrial conditions, it had been necessary to postpone further action for the present.

Upon the motion of Lord AVEBURY, seconded by Sir JOHN COCKBURN, K.C.M.G., the report was adopted, and the following were elected vice-presidents: The Lord Mayor of London, the Very Rev. William R. Inge, C.V.O. (Dean of St. Paul's), and Sir Richard A. S. Redmayne, K.C.B.

Dean INGE then addressed the meeting, taking as his subject "The Road to Ruin and the Way Out." He said that a diagnosis of social and industrial disease was the first necessity, and having made this, he found that the strike was the most serious feature. Science and religion were solutions of the existing unrest. Christianity, like science, said that they must get their values right, and religious idealism did not draw them away from happiness and progress.

Sir RICHARD A. S. REDMAYNE spoke on "The Importance of Research in the Development of the Mineral Industries."

The present state of the civilised world was, he said, economically, paradoxical. The necessity for commodities was very great, yet the production of them was so costly that industry was languishing for lack of orders. The explanation lay, he thought, in a combination of circumstances: A feeling of insecurity due to unsettled political and financial conditions. Hence, a disposition to conserve rather than to utilise in commercial ventures such capital as was available; the incidence of rate of exchange; the high cost of production consequent on the high cost of living and the higher standard of comfort demanded by the labouring classes (and rightly so demanded) than formerly obtained, and the lower and still apparently decreasing productive power of labour. The first two conditions would in part right themselves in process of time as the various political problems were solved, or partly solved, and rates of exchange would then tend towards the normal; but a very great deal depended upon the last two conditions, as the future position of production was not easy to forecast. The solution was the discovery by research of cheaper means of production, and, by research, to create new outlets. The cost of production of coal could be reduced by the wider application of the most up-to-date methods of "getting," in transporting and using coal. In some of our largest industries coal, next to wages, was the highest item of cost. The way of research, therefore, appeared to be along the lines of the more efficient use of coal. The economic utilisation of low-grade fuels was a matter of great moment. There were in this, as in all coal-producing countries, vast quantities of coal which it did not pay to work owing to the low price realisable thereon. Probably the use of so-called colloidal fuel offered a solution, and would render their use practicable and profitable.

The low temperature carbonisation of coal, too, was at present occupying the minds of many investigators, and might lead to the more extensive use of low-grade fuels.

The stores of liquid mineral oil would not last for ever; indeed, it was probable that the next fifty years would see, if not the complete exhaustion of this source of oil, at any rate a near approach to it. They must turn, therefore, towards distillation of oil-bearing mineral—oil shales and coal—to take the place of the present petroleum supplies.

The available reserves of high-grade iron ores in Great Britain were nearer exhaustion than were the coal supplies. More and more, too, the world would have to turn to the poorer grade of ore—a wide field was offered for research work in devising economic methods for its reduction.

Mr. Picard, in his presidential address to the Institution of Mining and Metallurgy in 1919, said in the province of general metallurgy the increasing use of the Cottrell process deserved special mention.

In the work of research the universities were peculiarly fitted to take an important—a leading—part. The Department of Scientific and Industrial Research might well endow university scientific research on chemical, metallurgical, and engineering work, supervising and co-ordinating and publishing the results.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Contactor Arc Splitter.

Inasmuch as magnetic control apparatus is now used for the control of electrical machinery in practically every industry, and as the reliability of any such system is directly dependent upon the reliability of the contactor, the latter in turn depending upon the proper functioning and durability of the contact tips, a new device recently developed by the Westinghouse Electric International Co., of East Pittsburgh, Pa., U.S.A., should be of considerable interest. By the use of an "arc splitter" it is said that the life of contactor tips used in conjunction with electric control equipment can be doubled. The improvement consists of a refractory element which is so placed in the arc box of the magnetic blow-out as to project into the path of the arc. This projection forces the arc to pass around it, and thereby lengthens its path. The lengthening of the arc increases its resistance

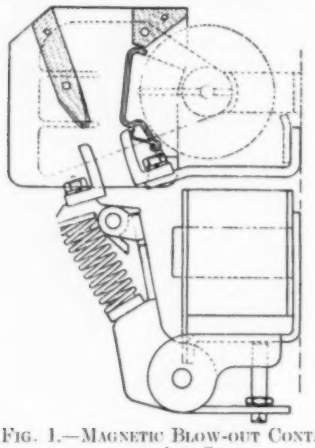

Fig. 1.—Magnetic Blow-out Contactor with Arc Splitter.

and causes it to rupture more rapidly, and, in addition, the travel of the arc over the surface of the splitter tends to cool the arc gases, which also causes the arc to rupture more rapidly. Quick arc rupture reduces the wear on the contacts and thus increases the life and reliability, not only of the contactor, but of the entire control system.

As shown in fig. 1, the arc splitter is placed immediately above the contactor tips. A transverse magnetic field is produced by the magnetic blow-out where the arc occurs, and the action of the arc in this field is similar to that which takes place in a motor when a current-carrying conductor is placed in a magnetic field. The conductor, which in this case is the arc, moves in the same direction as it would in an electric motor, and the arc is forced out by this movement and consequently lengthened. The action not only lengthens the arc, but also forces it against the splitter which accentuates this action.

A New Method of Stage Lighting.

Lighting is an enormously influential factor in the production of modern stage plays; especially in plays of a spectacular nature and in those which appeal chiefly to the visual sense, lighting is *all* important. A play may be made or marred by light, and the producer, as a rule, knows exactly what he wants in the way of lighting effects; but, until recently, he has not been able to get the necessary apparatus. Where results in advance of the common standard have been achieved, they have usually been due to ingenious improvisations by the stage electrician.

The new system of stage lighting designed and manufactured by the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C. 4, is, however, claimed to be free from the common defects of, and as a consequence more effective and adaptable than, the traditional method.

Briefly described, the new equipment is a combination of three elements—the X-ray mirror reflector, the Mazda gas-filled lamp, and a metal framework to hold coloured gelatine slides. The required number of units, each consisting of a lamp, reflector, and colour slide, are assembled in a specially-designed metal trough.

B.T.H. stage lighting equipment is supplied in four different patterns, viz., (*a*) concentrating battens which are intended for the intense illumination of particular sections of the stage. They are equipped with "Jupiter" X-ray reflectors and with either 100 or 200-watt Mazda gasfilled lamps. Using 100-watt lamps, this form of batten gives a downward illumination of 1,000 c.p. per lamp, that is, a batten containing 30 100-watt lamps would project a light of 30,000 c.p. on to the stage; (*b*) for the general illumination of the stage distributing battens (fig. 2), equipped with "Scoop" X-ray reflectors and 100 or 60-watt Mazda gasfilled lamps are recommended, while (*c*) special "E. 60" X-ray reflectors and 60-watt gasfilled lamps are used in the float and proscenium strip. Fig. 3 illustrates footlights.

It is said that in many cases the installation of B.T.H. equipment may be expected to bring about increases in overall efficiency of up to 200 per cent. Another economical advantage is that a smaller number of larger lamps can be used, thereby reducing the expense of replacements and maintenance, and the fact that in the new system it is not necessary for the lamps themselves to be coloured, saves them from a great deal of the handling and consequent breakage to which such lamps are commonly exposed.

From the colour standpoint the system under review is

Fig. 2.—B.T.H. X-ray Distributing Batten.

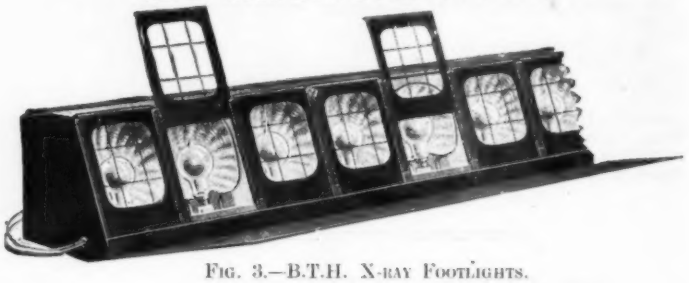

Fig. 3.—B.T.H. X-ray Footlights.

superior to earlier methods. Colour effects are obtained by the use of gelatine slides; over the mouth of each reflector is fitted a sliding frame into which the gelatine is slipped, and it is very easy to change the colours about as desired in a few seconds by the substitution of one set of slides for another.

The B.T.H. system has already been installed in two of the leading London theatres, and the equipment for several other theatres is now being made. We understand, by the way, that this company is busy with the manufacture of other

few seconds by the substitution of one set of slides for another.

able utility in the theatrical world.

The 'Priory'" Ceiling Fitting.

We have received from The Priory Electrical Engineering Co., Ltd., Bath Street, Birmingham, a sample of a new type

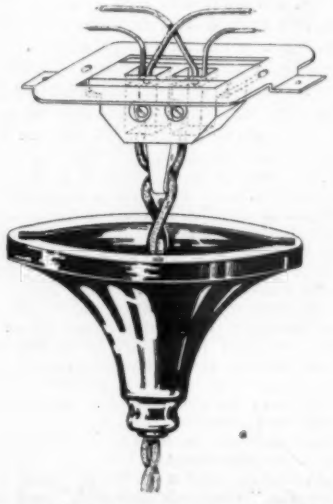

Fig. 4. The "Priory" Ceiling Fitting.

of ceiling fitting which they have introduced. This fitting, which is illustrated in fig. 4, comprises a rectangular brass

clamping plate provided with a lug at each end and holes for screws to fix it to a ceiling. A block of insulating material is held by two retaining pieces forming part of the plate, and in this block two terminals are fitted. The other part, completing the device, is a metal cone which fits over the block and plate; two recesses on an inner rim fit over the end lugs of the brass clamping plate, and the cone is turned until two small stops on the lugs engage with corresponding holes in the rim. An insulating bush is fitted in the entry hole at the apex of the cone. The cone is made in various finishes, as Florentine bronze, old brass, &c., and is very effective in appearance. The chief advantages claimed for the new fitting are an absence of breakable parts and a reduction in the labour necessary for fixing the device.

A Neon Lamp Adapter.

The Neon lamp has at present only been generally developed in a ¼-c.p. size, and for this reason is not suitable for ordinary lighting purposes. It is, therefore, necessary to make arrangements for a more powerful lamp as well, the Neon lamp being used only when little illumination is required. To obviate the necessity of changing lamps for this purpose, Electrical Utilities, Ltd., has recently brought out a double adapter in which two lamps, one Neon and one ordinary type, can be fixed. It is fitted with an internal switch actuated by a metallic bar and cords are attached to the bar enabling either of the lamps to be switched on easily. The device is called the "Dim-Bright" adapter.

Celastoid.

A new safety celluloid entitled "Celastoid" has been introduced by the British Cellulose & Chemical Manufacturing Co., Ltd., of 8, Waterloo Place, S.W.1; it is claimed that this material has the good qualities of ordinary celluloid without the bad ones. It is non-explosive, non-porous, non-hygroscopic, can be worked, moulded, drilled, &c., with ease, and takes a high polish; it can be jointed with acetone solution and similar solvents, and can be supplied transparent or of any desired colour, in sheets, rods, and tubes. It has a dielectric strength of 720,000 volts per centimetre. Amongst the varied uses to which it has already been put are electric light fittings and bowls, covering telephone receivers, and fan blades.

A New Electrical Vulcaniser—Correction.—Owing to an addition to a proof the final sentence of the description in our last issue read: "The illustration is reproduced from the motor." We intended, of course, to acknowledge our indebtedness to our contemporary of that name.

THE FARADAY SOCIETY.

THE PROBLEM OF THE FUEL CELL.

The possibilities of converting the potential energy stored up in carbon or coal directly into electrical energy, through the medium of a primary battery, seem to exercise a perennial fascination on inventors. This is not to be wondered at when we recollect that the best means of transformation at our disposal—gas-producer, gas engine, and dynamo—only yields a 25 per cent. return, while the more usual construction of boiler, steam engine, and dynamo reduces the figure to 10 or 15 per cent. The prize awaiting the inventor—or the exploiter—of the successful fuel-cell is assuredly beyond the dreams of avarice. In the meantime many have attempted the solution, and if none has succeeded, the trial has yielded results of considerable interest to the electrical engineer, and certain promising avenues of advance have been indicated that are well worthy of further exploration. The paper on this subject, therefore, read before the Faraday Society on May 9th by Dr. E. K. Rideal and Mr. U. R. Evans served a useful purpose in focusing interest and discussion on fuel-cells, and in summing up for us the attempts of the past and the possibilities of the immediate future.

The authors classified fuel-cells under the headings of: (1) Direct; (2) semi-direct; and (3) indirect fuel-cells. In the first class solid fuel is burnt, but the electrodic reactions are so slow that polarisation is very great, and this has so far prevented the construction of a useful cell. Most of the cells are too well known to call for description here, excepting the Baur and Ehrenberg type, in which a carbon box is the anode, fused borax the electrolyte, and fused silver saturated with air the cathode, equivalent to an oxygen electrode. The cell yields 0.95 volt which drops to 0.5 volt when yielding a current of 90 milliamps.

The Read cell is also interesting. In this, thin gold foil is the cathode, and fused borax containing manganese (added as manganese dioxide) is the electrolyte. A battery of six cells has been constructed in series, built one on the top of the other, in a rather ingenious manner. The whole cell is contained in a shallow Battersea crucible, which arrangement provides in the cathode compartment a large surface area of contact between the fused bath and the atmosphere, with a view to maintaining the manganese in the oxidised condition. Air is not bubbled through the liquid. The attackable material at the anode is powdered coal, in which a graphite electrode cut into the form of a grid is embedded, and serves to put the whole into electrical contact with the external circuit.

Each cell of this battery gave an e.m.f. of 0.9 volt, and a current of 185 milliamps. over a 4½ ohms resistance falling at the end of an hour to 157 milliamps. This current is not unsatisfactory considering the size of cell used, but the drop is very significant.

In the second type of cell the coal is converted into a gaseous fuel, carbon monoxide, or hydrogen, and the gas used in the cell. The famous Grove gas cell is an example of this type, and an improved form of it was long ago made by Mond and Sanger in which very large electrode areas were provided to minimise polarisation. The use of platinum in this cell puts it out of court. Baur and Ehrenberg have also constructed cells of this type, using nickel saturated with carbon monoxide or hydrogen as positive electrode, fused borax as electrolyte, and molten silver containing oxygen as negative electrode. With the former gas polarisation was rapid, but the hydrogen cell giving 1 volt on open circuit dropped only to 0.5 volt when providing a current of 60 milliamps.

The indirect fuel cells are either of the oxygen-reduction type or the metal-anode type. A typical cell is that of Jungner, improved by Taitelbaum. In the former two carbon electrodes are immersed in warm concentrated sulphuric acid in separate compartments. The cathode is graphite, and air is forced into the cathode compartment; the anode is lumps of carbonaceous matter. The acid in the cathode chamber contains an oxygen-carrier such as nitric oxide, that in the anode chamber becomes charged with sulphur dioxide due to reaction between the acid and the fuel. In Taitelbaum's variety salts of metals which exist in two states of oxidation (*e.g.*, Fe, Hg, Cc, Th, and V) act as oxygen carriers, and the metal is kept in a highly oxidised condition in the one compartment by the action of the air, and in the reduced condition in the other by the action of the fuel—coal gas, acetylene, or similar fuels. On the whole vanadium was the most promising metal to employ, and in one cell at 200 deg. C. a voltage of 0.65 was obtained which, however, dropped to 0.2 volt with a current of 100 milliamps. At 250 deg. C. the voltage was 0.35.

Much interesting experimental work in this direction has been done by Nernst, who has aimed at producing an oxidation and reduction cell which would work at from 40 to 60 deg. C., and appears to favour titanium, thallium, and cerium. He has also suggested the use of chlorine gas, produced (and regenerated) by the Deacon process, as the oxidising agent in certain fuel cells. The production of current by the recombination of the hydrogen and chlorine produced at electrolytic alkali works is suggested as a promising field for investigation.

Nernst would seem to be of the opinion that the most important factor in an indirect cell is the velocity with which the fuel will reduce the metal to the lower state of oxidation and the velocity with which the air will oxidise the metal in the other compartment. Unless the reducing and oxidising reactions can keep pace with the production of current, it is clear that the cell will, sooner or later, cease to work, when the materials originally added will have become exhausted. The authors point out that polarisation depends both on the electrode area and the cell volume, and it is the second factor which introduces the element of time.

Dr. Rideal and Mr. Evans next described the experimental work they themselves have recently carried out. One part of this dealt with the trial of fused electrolytes which are not oxidising agents. One example was "phosphate glass mixture" consisting of one part sodium pyrophosphate and two parts potassium dihydrogen phosphate. This mixture when fused dissolves most oxides readily (to form "glosses"), and it formed a ready medium for studying the oxidising and reducing effects already referred to. A cell built up on this principle, however, was not very promising in consequence of polarisation effects, and this line of advance was abandoned.

Finally, the authors experimented on the metal-anode type of cell. At first thoughts this would not be called a fuel-cell; it becomes one indirectly (as, indeed, does every primary battery) if carbon or coal be used for reducing the oxidised anode. It was found that tin being easily reduced from its compounds was a likely metal to experiment with, and a series of cells was made with this metal and also with lead. The tin cells were hopeful. The one which gave the best results contained dilute hydrochlorine acid with a cast tin anode in the outer jar and a carbon electrode inside a porous pot as the cathode, immersed in a solution of hydrochloric acid and ferric chloride. Air was bubbled continuously through this mixture. It was found that when the ferric chloride was regenerated at the suitable rate, depending on the current flowing, a steady voltage of about 0.66 resulted. There was less polarisation at 80 to 100 deg. C., but other difficulties arose which probably could be overcome. Unfortunately the experiments have had to be abandoned for the time being, and there the matter stands.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

15,543. "Electric switches and fuses." W. L. Barber and Midland Electric Manufacturing Co. June 6th.
15,587. "Cutters for removing insulation from electric wires." V. S. King. June 6th.
15,591. "Control systems for electric motors." Metropolitan-Vickers Electrical Co., Ltd. June 6th. (United States, June 9th, 1920.)
15,607. "X-ray tubes." W. E. Schall. June 6th.
15,611. "Means for generating thermodynamic energy." H. Richardson. June 6th.
15,618. "Electric flashing apparatus." W. J. Mellersh-Jackson (Bossard Railway Signal Corporation). June 6th.
15,625. "Tidal hydro-electric engine." P. Bowie. June 6th.
15,631. "Electric locomotives." H. Clough and Greenwood & Batley, Ltd. June 7th.
15,645. "Magneto-electric machines." R. Bosch Akt.-Ges. June 7th. (Germany, June 7th, 1920.)
15,649. "Electric connections." H. Moon. June 7th.
15,654. "Sparking-plugs." Igna Engineering Co., Ltd., and H. R. Wilks. June 7th.
15,670. "Electro-magnetic chucking device." F. Krupp Akt.-Ges. June 7th. (Germany, July 24th, 1920.)
15,681. "Automatic cut-outs." J. Richards. June 7th.
15,722. "Multiple electro-mechanical relay for equilibrated polyphase electric circuits." A. Balducci. June 7th.
15,737. "Power plants." British Thomson-Houston Co., Ltd. (General Electric Co.). June 7th.
15,746. "Electric water-heater." F. H. Austen. June 7th.
15,759. "Automatic voltage selector." J. Henderson. June 8th.
15,782. "Electric heating appliance." W. Smith and J. T. Smith. June 8th.
15,805. "Electro-magnetic apparatus for recording sound." A. F. Sykes. June 8th.
15,811. "Time-controlled electric switch-operating devices." G. S. James. June 8th.
15,823. "Electric insulators." Metropolitan-Vickers Electrical Co., Ltd. June 8th. (United States, July 7th, 1920.)
15,826. "Electric cables or conductors." J. Drennam. June 8th.
15,827. "Cooling apparatus for oil transformers." Akt.-Ges. Brown, Boveri et Cie. June 8th. (Switzerland, December 9th, 1920.)
15,829. "Insulating compositions and coverings." G. W. Orrock. June 8th.
15,838. "Automatic telegraph systems." Western Electric Co., Ltd. June 8th. (United States, July 1st, 1920.)
15,845. "Multiple fuse." J. Szykier. June 8th. (Germany, June 9th, 1920.)
15,846. "Combined plug receptacles and switches." British Thomson-Houston Co., Ltd. (General Electric Co.). June 8th.
15,860. "Illuminable advertising-devices for telephone call-boxes, &c." O. Schowing. June 8th.
15,869. "Electro-magnetic stop motions for textile machinery." C. Smith, E. W. Varley, N. Whitehead, W. Whitehead, and W. & J. Whitehead. June 9th.
15,886. "Ignition commutators for internal-combustion engines." S. J. Murphy. June 9th.
15,891. "Apparatus for recording and checking telephone calls." G. W. Humphrey. June 9th.
15,911. "Electro-magnetic chucking devices." F. Krupp Akt.-Ges. June 9th. (Germany, July 26th, 1920.)
15,917. "Piezo-electric devices." A. F. R. Cotton. June 9th.
15,927. "Alternating-current electricity meters, &c." Ferranti, Ltd., S. Z. de Ferranti and G. Wall. June 9th.
15,928. "Alternating-current electricity meters, &c." Ferranti, Ltd., S. Z. de Ferranti, and G. Wall. June 9th.
15,929. "Direct-current electricity meters of the mercury motor type." Ferranti, Ltd., S. Z. de Ferranti and G. Wall. June 9th.
15,932. "Generator." D. Suchostawer. June 9th.
15,940. "Suspension device for overhead conductor wires for electric railways, &c." Sir P. Dawson and F. W. Fawdry. June 9th.
15,973. "Enclosed electric cartridge fuse of the dust-filled type." C. H. Moss. June 9th.
15,988. "Turbo-generator for road vehicles." W. Holmes and H. Phillips. June 10th.
15,990. "Fitting for clamping and connecting electric cables in wiring, &c., systems." British Insulated & Helsby Cables, Ltd., F. A. Cole and H. Leicester. June 10th.
15,995. "Appliance for reflecting electric arc of a kinematograph lamp upon a screen, &c." W. Holmes. June 10th.
16,003. "Brush-holders in dynamo-electric machinery." J. W. Drake and G. A. Kirk. June 10th.
16,009. "Electric fuses and fuse-boards." P. B. Handley. June 10th.
16,010. "Electric terminals." P. B. Handley. June 10th.
16,011. "Electric switches." P. B. Handley. June 10th.
16,030. "Junction box for intercommunication telephone systems." E. G. Brown. June 10th.
16,034. "Incandescent electric lamps." A. C. Hyde. June 10th.
16,035. "Incandescent electric lamps." A. C. Hyde. June 10th.
16,036. "Liquid electric motor starter." R. F. Baerlocher. June 10th.
16,037. "Telephone exchange systems." L. Polinkowsky and Western Electric Co., Ltd. June 10th.
16,047. "Electric irons." A. Ruelland. June 10th.
16,062. "Flow meters." British Thomson-Houston Co., Ltd. (General Electric Co.). June 10th.
16,065. "Electric switches and switch holders." H. Garde. June 10th.
16,121. "Apparatus for use with train control, &c., systems." Automatic Telephone Manufacturing Co., Ltd., and A. F. Bound. June 11th.
16,148. "Electrolytic treatment of metalliferous materials containing tungsten or molybdenum." E. N. Craig, Durelco, Ltd., and R. E. Pearson. June 11th.
16,156. "Electric signalling." Eastern Telegraph Co., Ltd., and F. E. Fernot. June 11th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

19,852. "Electrical resistance elements." W. Travis and T. H. Watson & Co. (of Sheffield), Ltd. August 13th, 1919. (163,727.)
24,116. "Telephone transmission systems." E. C. R. Marks (Macfarlane Communications Corporation). October 2nd, 1919. (163,728.)
24,556. "Contact for thief alarms or other electrically-operated devices." F. Cressall. October 8th, 1919. (163,729.)
24,599. "Electrical resistances." A. Lyon & Wrench, Ltd., W. Engelke, and J. C. Todman. October 8th, 1919. (163,730.)
29,887. "Mine signalling apparatus." H. Houghton and Chadburn's (Ship) Telegraph Co., Ltd. December 1st, 1919. (163,736.)
30,030. "Electric current limiting devices." J. Cleary and G. J. Philpot. May 27th, 1920. (163,737.)
31,927. "System and apparatus for enabling a movable object to pursue an electrically staked-out route in a more precise way than by means of visual points of reference." W. A. Loth. December 19th, 1919. (163,741.)
32,701. "Galvanic elements." F. Bocker and A. Eichhoff. December 30th, 1919. (163,744.)

1920.

974. "Electron discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). January 12th, 1920. (163,745.)
5,173. "Transmitters for electric recording and signalling systems." J. S. Wilson (A. B. Buckley). February 20th, 1920. (163,773.)
5,496. "Ignition devices for internal-combustion engines and the like." W. Pickard and D. R. Dobson. February 24th, 1920. (163,786.)
5,555. "Method of and means for operating tipping gear upon vehicles electrically." P. F. Smith, E. H. Dine and F. R. Stocks. February 24th, 1920. (163,792.)
5,560. "Ignition magnetos for internal-combustion engines." H. Lucas and H. W. F. Ireland. February 24th, 1920. (163,794.)
5,578. "Construction of the field magnets of dynamo-electric machines." G. Schroeder. February 24th, 1920. (163,796.)
5,611. "Electrical control apparatus for lighting systems and the like." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). February 25th, 1920. (163,800.)
5,785. "Telephone systems using call indicators." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). February 26th, 1920. (Cognate applications, 12,291/20, 29,153/20, and 31,298/20.) (163,807.)
5,813. "Receivers for wireless telegraphy and telephony." E. Houghton and Portholme Aircraft Co., Ltd. February 26th, 1920. (163,810.)
5,845. "Fuse and junction or terminal boxes for electric-lighting installations." J. Stone & Co., Ltd. (M. Walton). February 26th, 1920. (163,812.)
6,101. "Apparatus for subjecting substances of molecular matter to the electrostatic stress of a high-tension electric discharge." F. G. Niece and R. M. Leggett. February 28th, 1920. (163,823.)
7,142. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd. (General Electric Co.). March 9th, 1920. (163,838.)
7,361. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). March 3rd, 1920. (163,845.)
7,631. "Secret contact electric switch devices for preventing the theft of motor-vehicles." F. Peart and A. H. Ruddle. March 15th, 1920. (163,847.)
7,809. "Gasfilled electric incandescent lamp." Siemens & Halske Akt.-Ges. September 20th, 1913. (140,427.)
8,177. "Radio navigational apparatus and the like." J. Erskine-Murray and J. Robinson. March 19th, 1920. (163,855.)
8,778. "Magneto-electric apparatus." A. Burlat and A. Renaudin. March 26th, 1919. (140,791.)
9,721. "Spark plugs." L. S. Flatau. April 7th, 1920. (163,875.)
11,392. "Electrically-operated rivetting, pressing, stamping, and the like machines." E. Adamson. April 24th, 1920. (Addition to 130,651.) (163,887.)
12,716. "X-ray plates and the like." L. A. Levy and A. L. Landau. May 7th, 1920. (Cognate application 30,292/20.) (163,903.)
13,182. "Electric regulating switches." M. Mansell. May 12th, 1920. (163,907.)
14,652. "Induction electricity supply meters." A. Schuster. August 15th, 1918. (143,228.)
14,851. "Tone arms and amplifiers for talking-machines." A. E. Roberts. December 2nd, 1920.) (163,917.)
16,618. "Electric push-button switches." W. T. Ohrstrom. June 19th, 1920. (163,925.)
18,910. "High-frequency signalling." Western Electric Co., Ltd. March 3rd, 1916. (146,988.)
21,868. "Terminals for binding-posts for electric wires." J. T. Callaway and S. A. Callaway. July 21st, 1920. (163,934.)
29,903. "Sparking-plugs." A. W. Armstrong. October 22nd, 1920. (163,959.)
34,536. "Sparking-plugs for internal-combustion engines." F. Monin. December 8th, 1919. (154,932.)
35,308. "Process for feeding electric traction lines supplied with direct current." E. Sorelli. December 15th, 1919. (155,296.)
35,931. "Means for detecting damaged ramps in train electrical control systems." R. Haddan (J. B. Regan). November 7th, 1919. (Divided application on 158,669.) (163,962.

1921.

1,242. "Sparking-plugs." L. Siegl. July 28th, 1919. (157,330.)
5,755. "Electricity meters." Chamberlain & Hookham, Ltd., and S. James. November 20th, 1919. (Divided application on 162,015.) (163,963.)
9,195. "Process for suppressing upper-harmonic anode currents in metal vapour rectifiers fed through polyphase transformers." Akt.-Ges. Brown, Boveri et Cie. April 1st, 1920. (160,815.)

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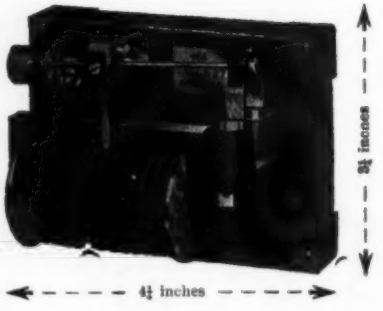

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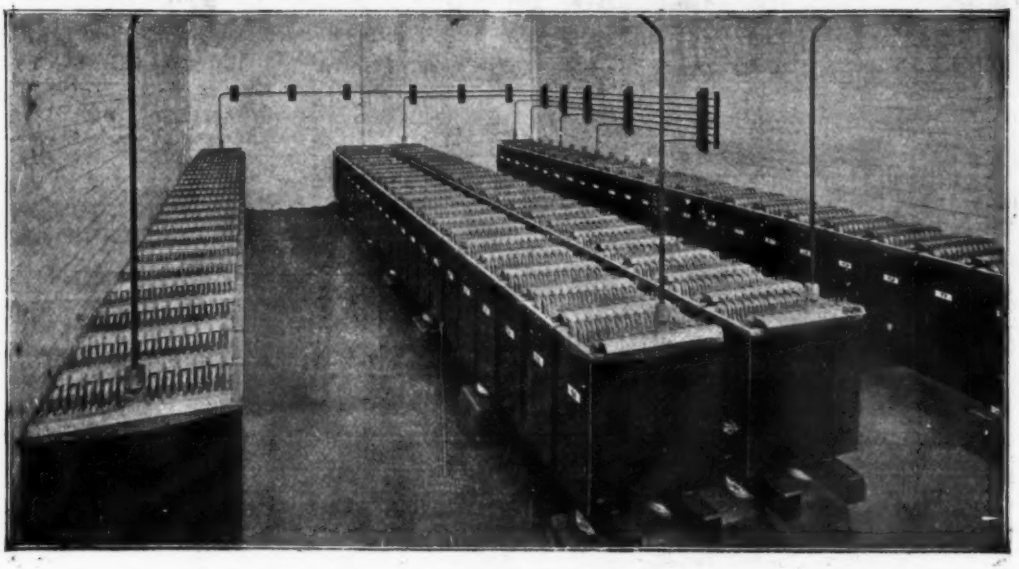

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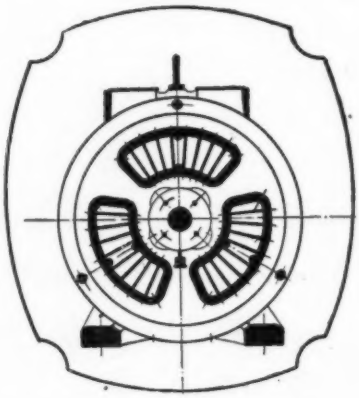

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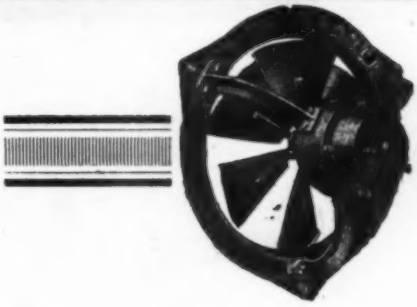

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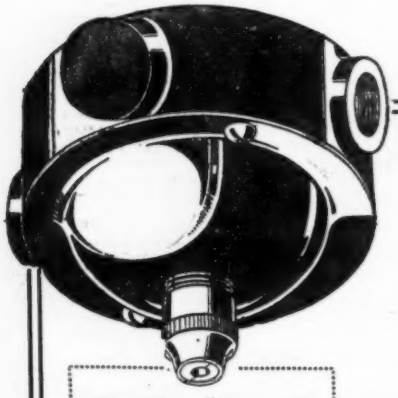

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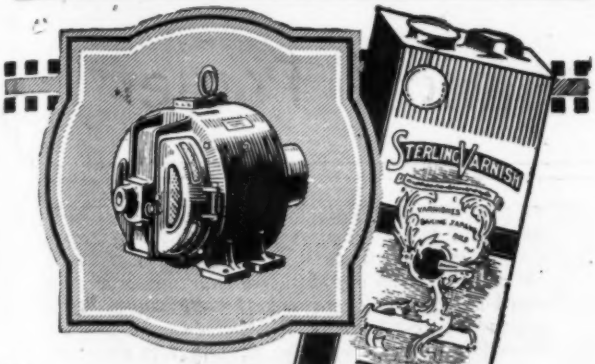

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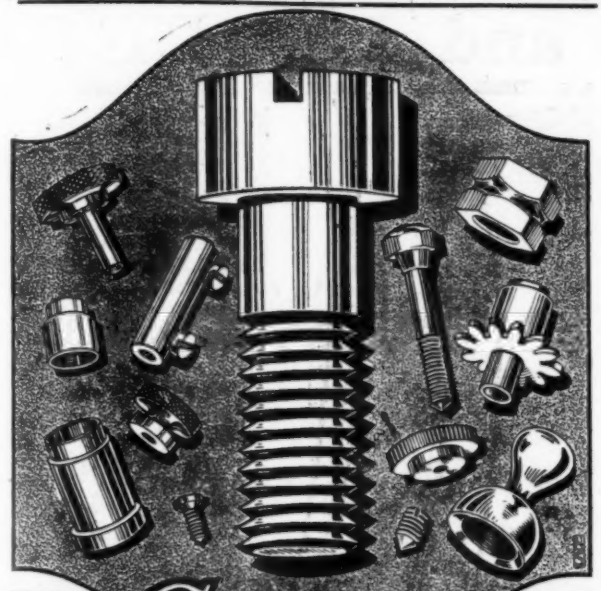

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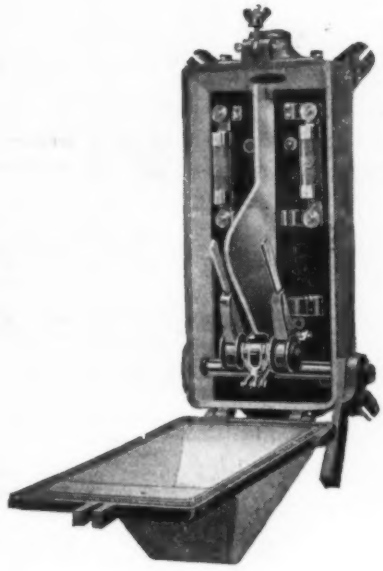

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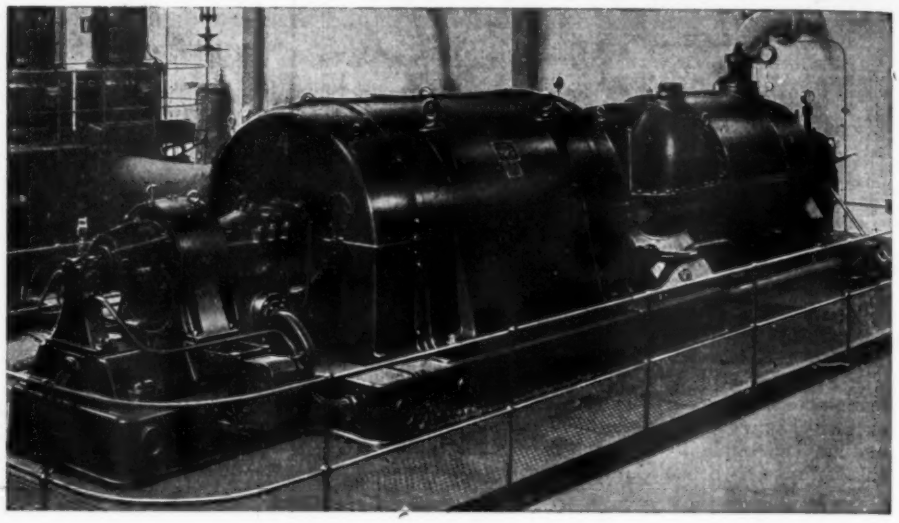

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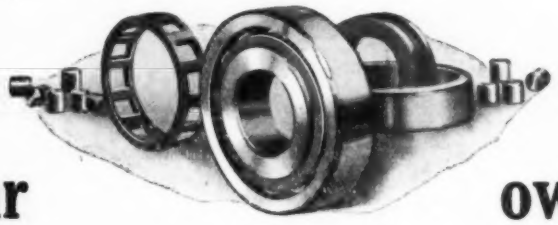

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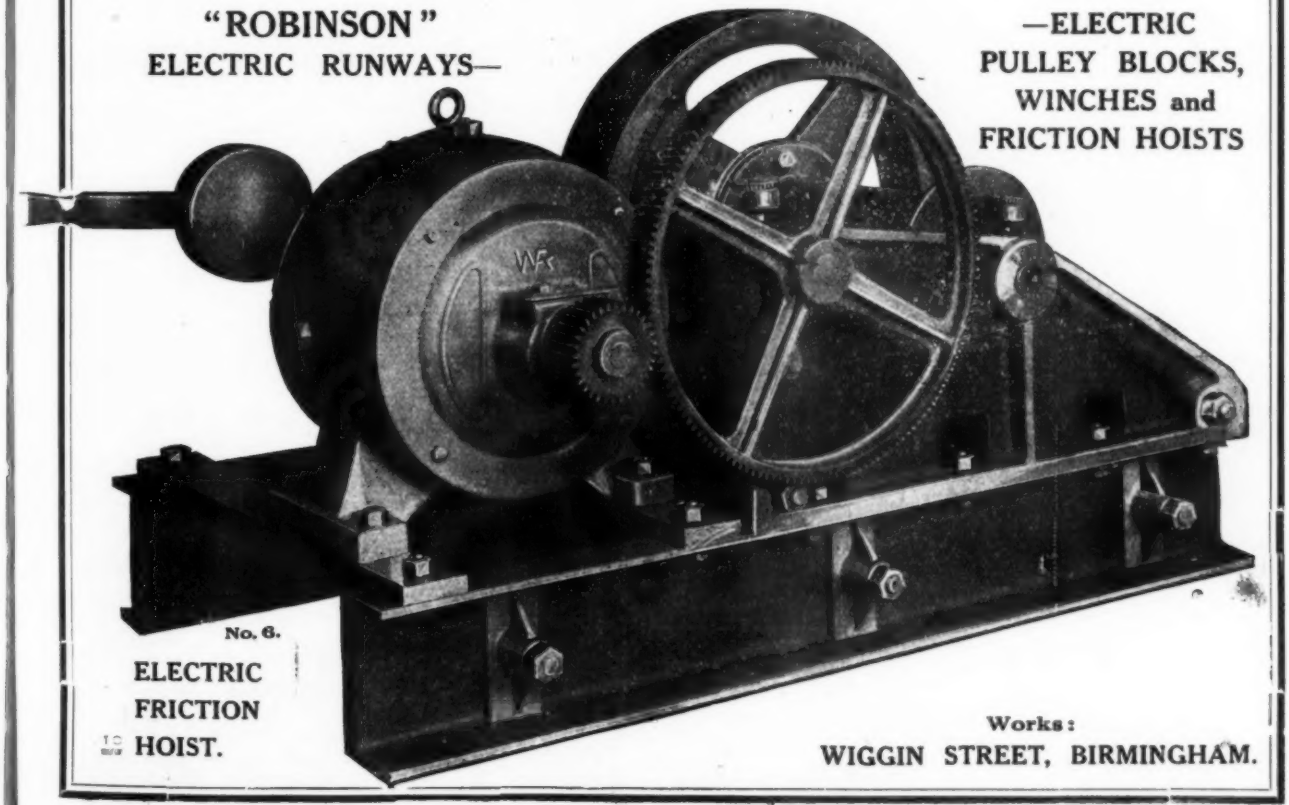

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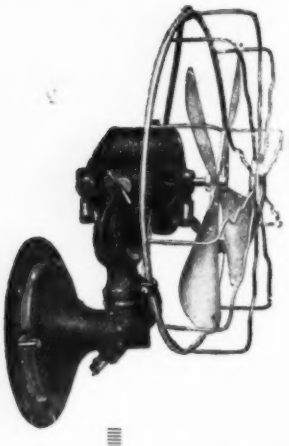

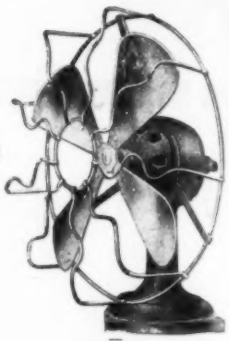

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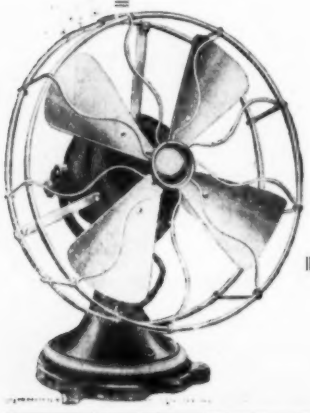

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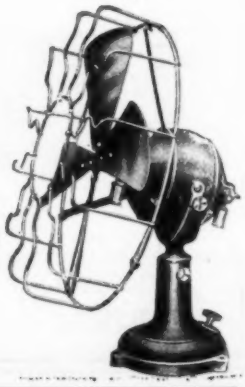

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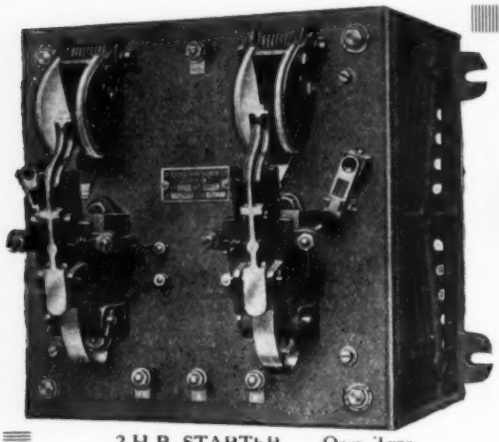

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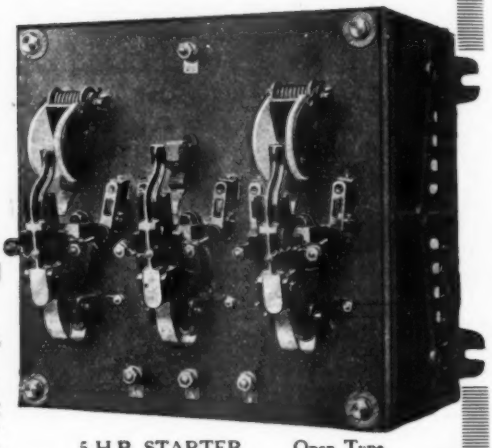

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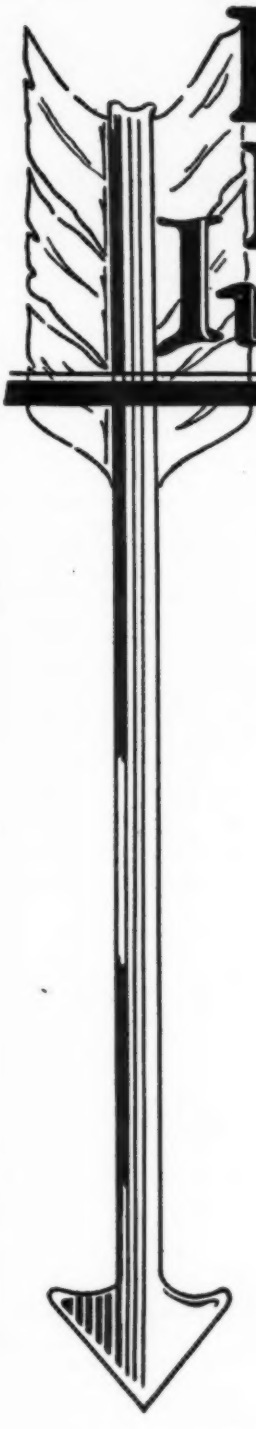

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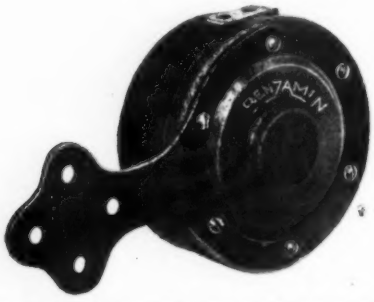

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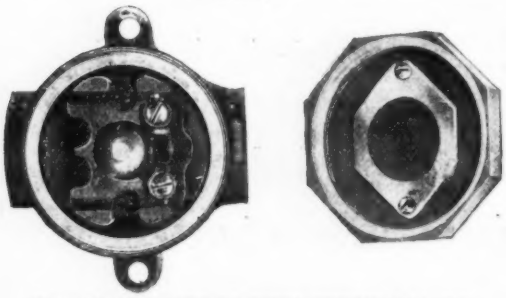

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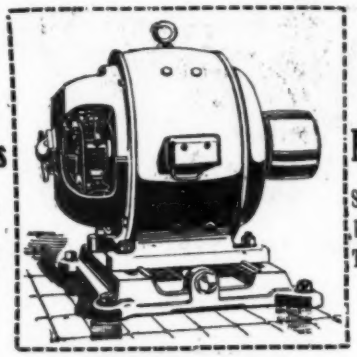

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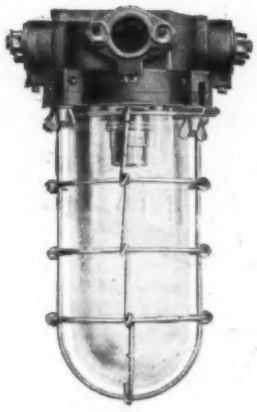

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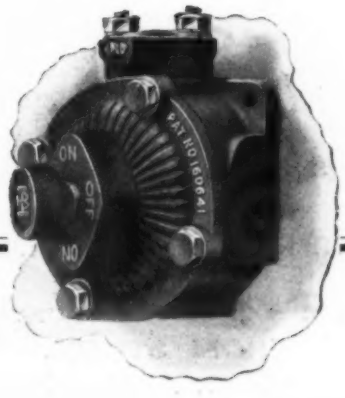

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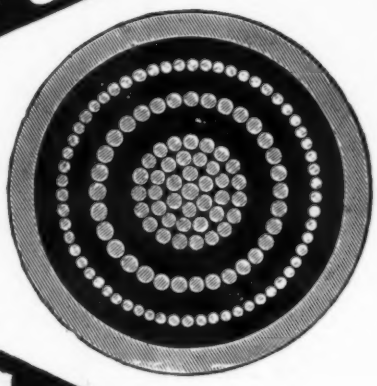

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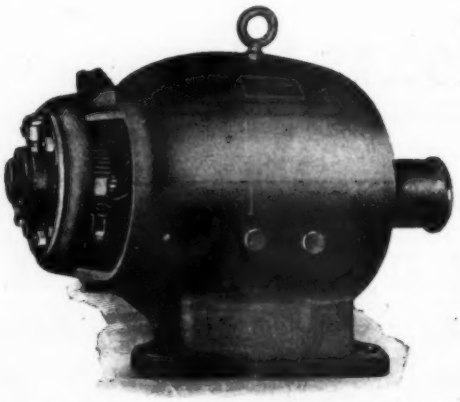

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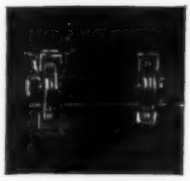
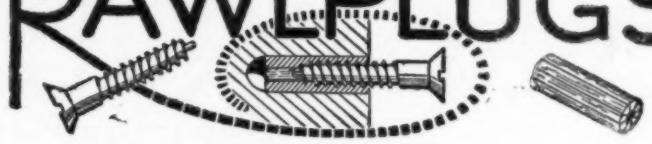


Fixture to tiles by the old method.

RAWLPLUGS



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By the Rawlplug method, wood blocks, lead fillings, and bolts and nuts are entirely dispensed with for fixing.

Rawlplugs are small cylindrical patent fibre plugs of British manufacture. They are inserted in a hole (smaller than the head of the screw), and when the screw is turned into a Rawlplug it automatically expands, a firm grip being obtained against the sides of the hole; at the same time the screw is held firmly in position by a perfect thread being formed in the fibre.

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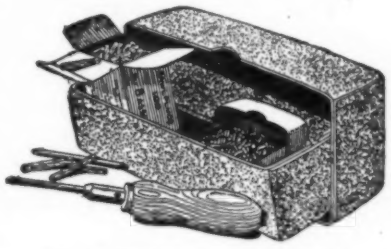

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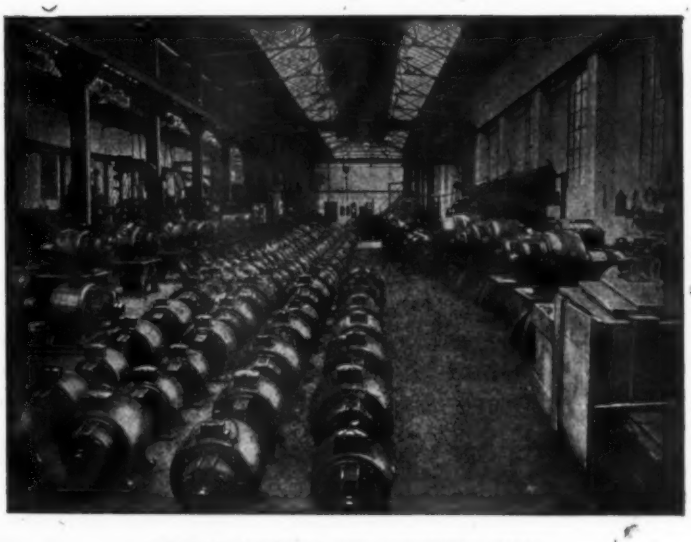

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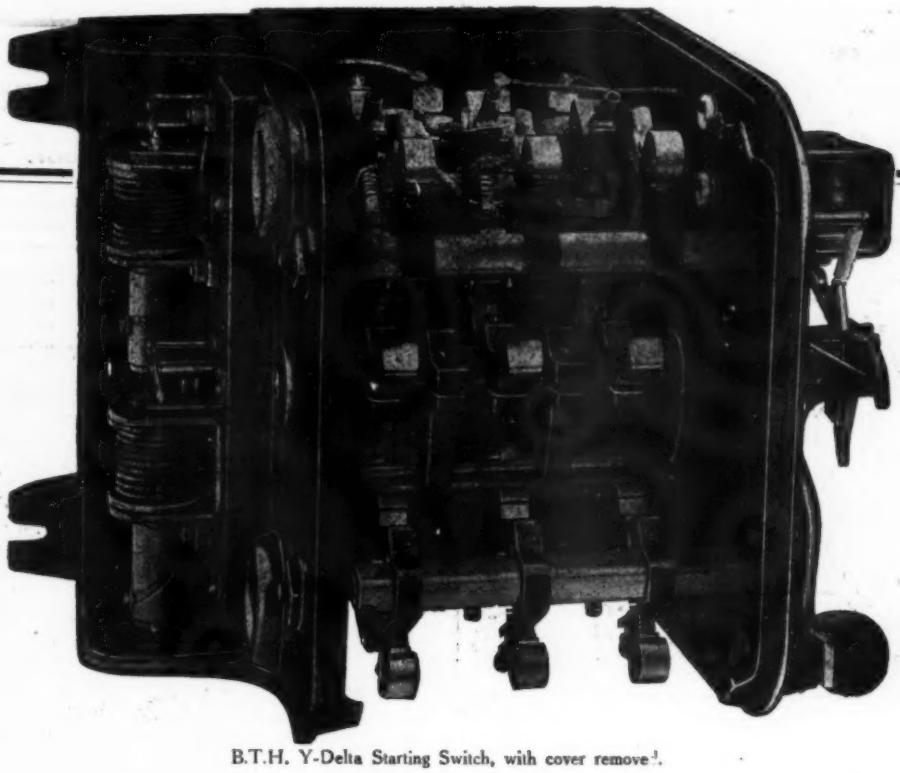

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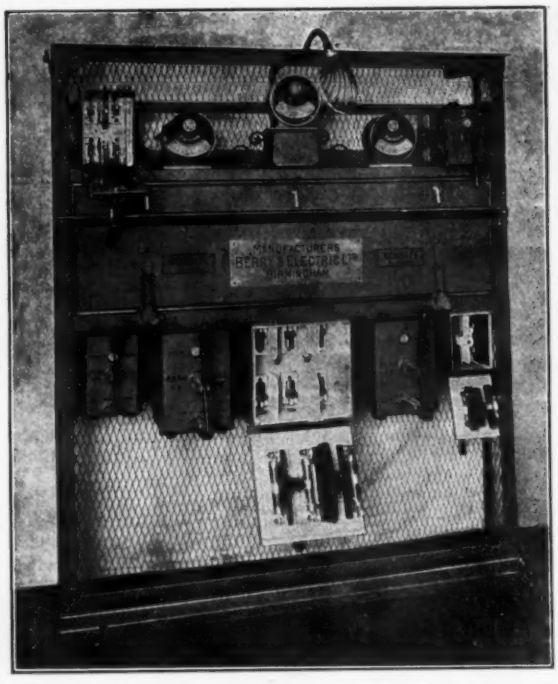

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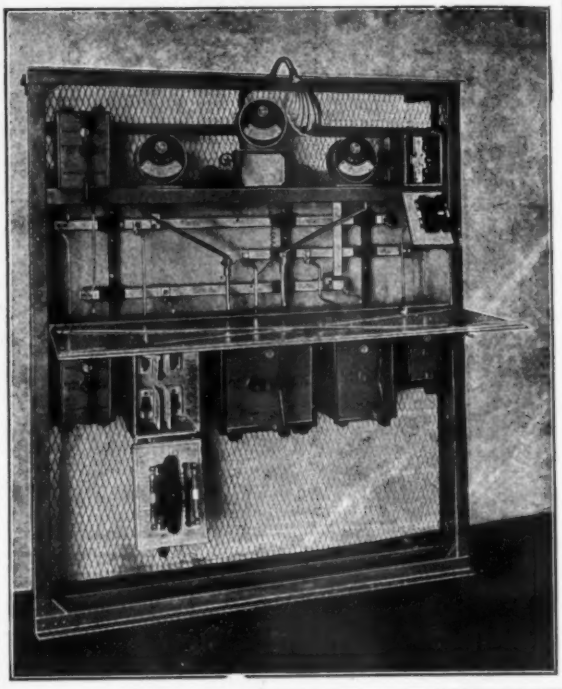

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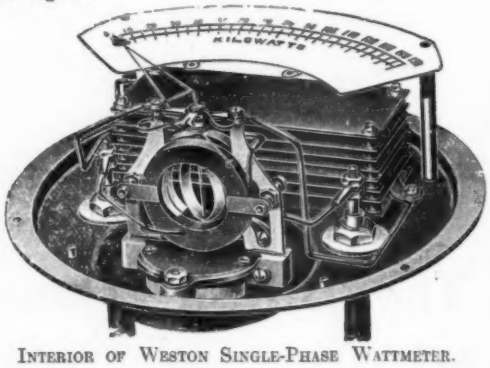

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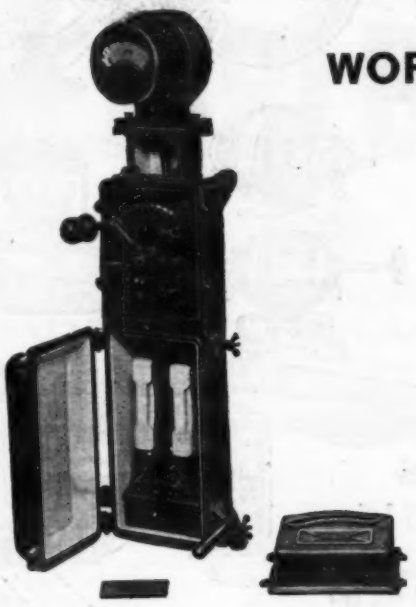

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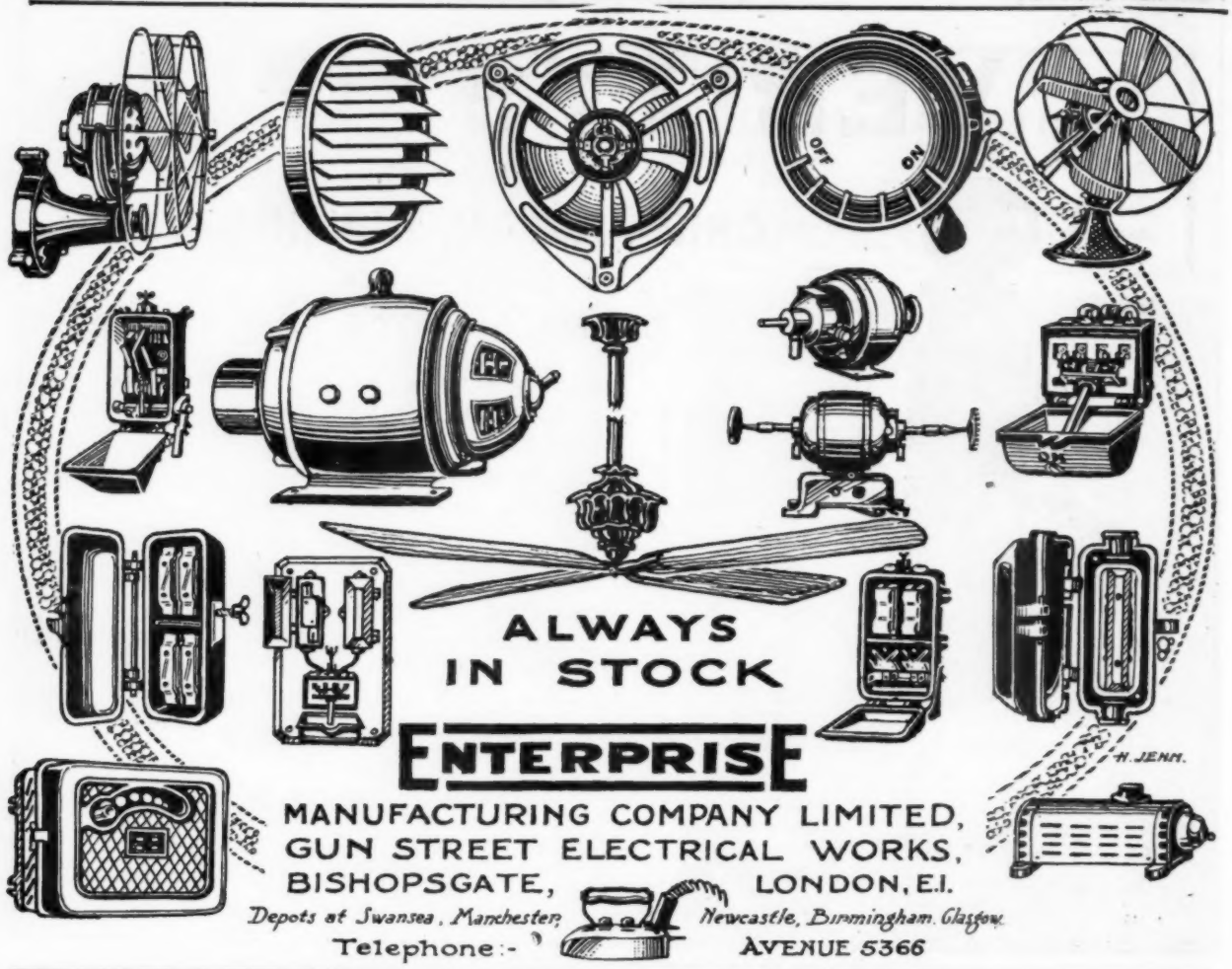

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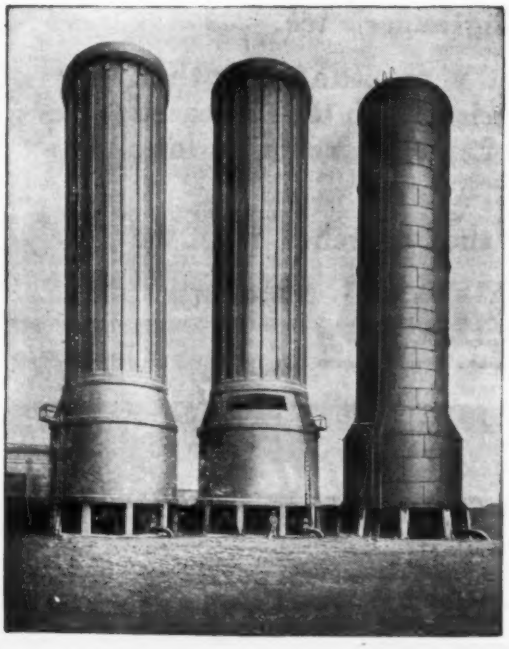

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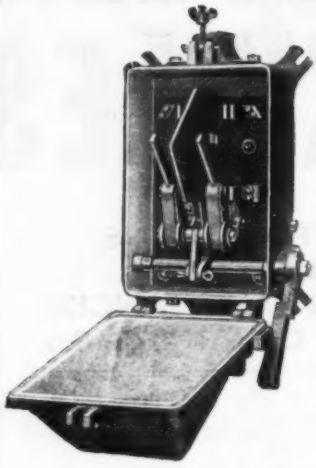

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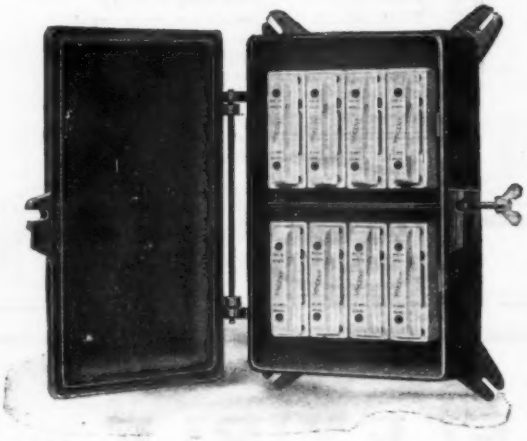

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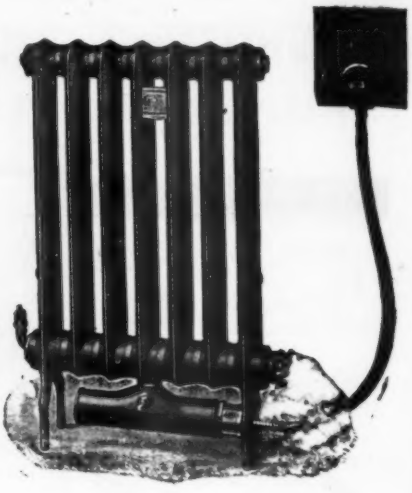

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(PATENT.)

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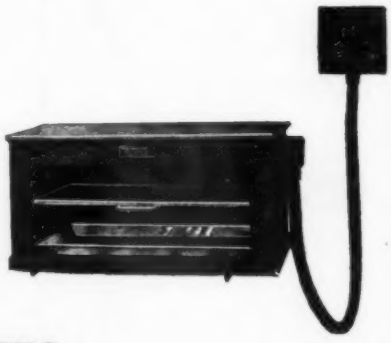

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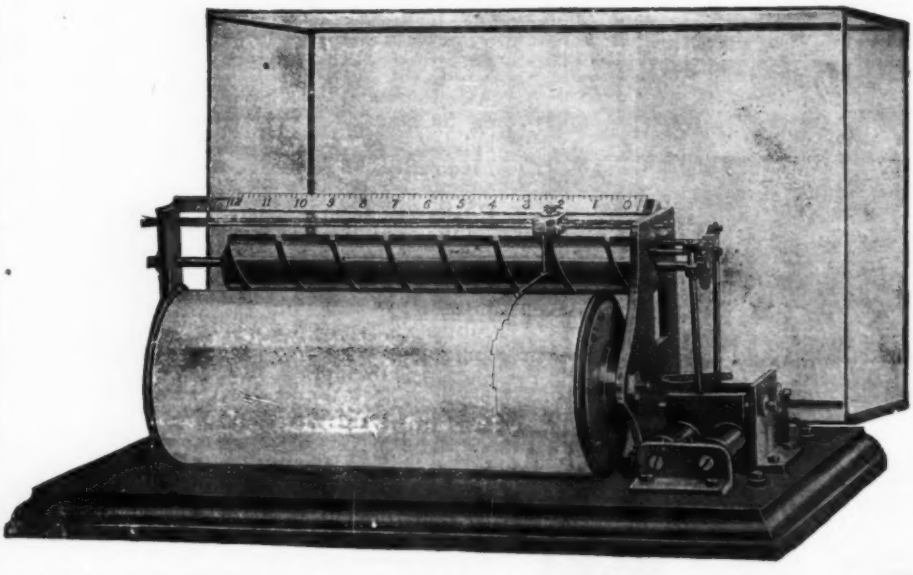

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The illustration shown here depicts a panel so equipped. Each unit is complete with all necessary interconnections at back of panel so that in fixing up the minimum of work is involved.

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CONFORMS TO HOME OFFICE REQUIREMENTS.

For Direct Current Motors.

The D.C. Lever Switch Type Motor Control Panel is similar in general appearance to the A.C. Panel. The sheet steel base, however, is mounted with a Double Pole Ironclad Combined Type Lever Switch and Cartridge Fuses and a Type "S D" Enclosed Ventilated Motor Starter with no-volt and overload releases.

The illustration shown, depicts a D C. Panel equipped with a Moving Iron Ammeter of suitable range.

Each unit is complete with all necessary interconnections at back of panel. When fitting up, the only connections to be made are the mains and the motor leads.

Typical D.C. Panel.

CONFORMS TO HOME OFFICE REQUIREMENTS.

Write for Leaflets :—
A.C.—V82b/2-3.
D.C.—V82a/2-3.
Or let us . Quote to your Requirements.

THE Mark of Efficiency.

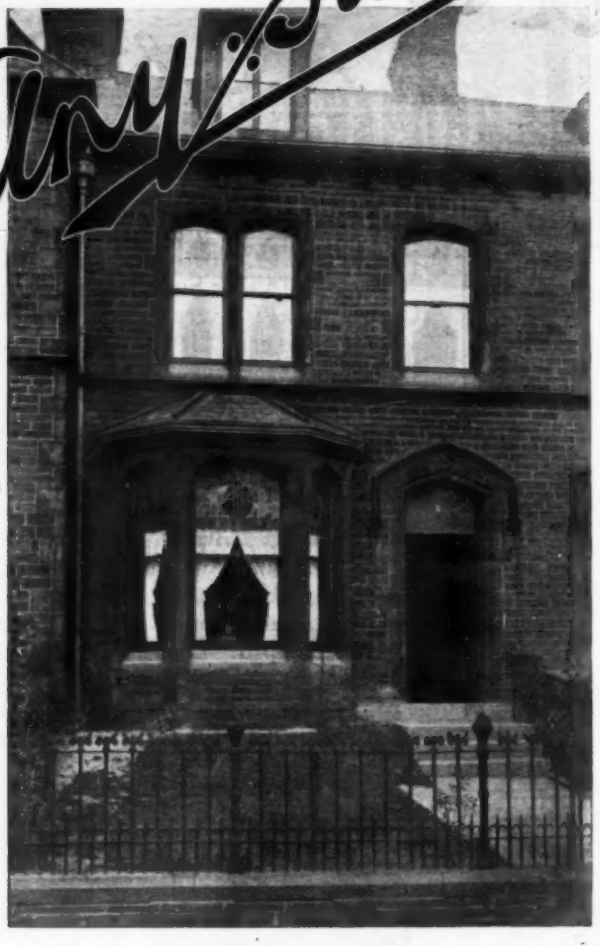
305

METROPOLITAN-VICKERS

ELECTRICAL COMPANY LIMITED. TRAFFORD PARK MANCHESTER.

MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV MV

No. 5 City Street



HITHERTO the buildings we have illustrated as wired on the J. & P. System have possessed some distinctive feature, even if only that of newness. The one we show above, however, is deliberately selected as being neither new nor uncommon.

It is a house of a type which our English towns contain in scores of thousands. We reproduce the view to remind you that the J. & P. Wiring System is the best and cheapest for the every-day job as well as the special one—the system which can be installed in houses already built, with the minimum of expense and disturbance to decorations.

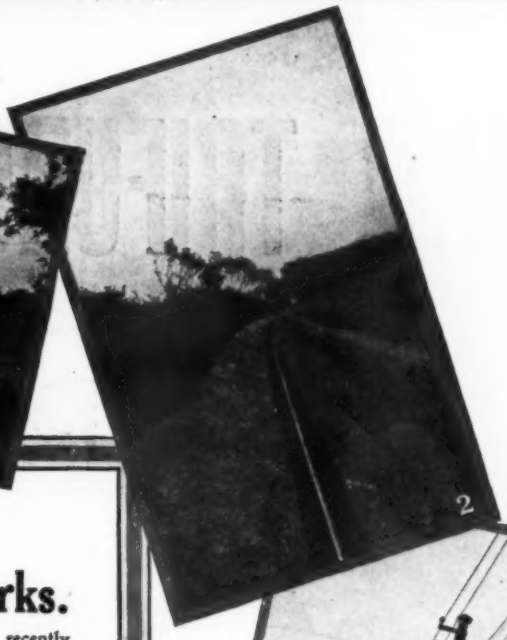
Mr. Harry Moss, A.M.I.E.E., 82, Leeds Road, BRADFORD, kindly supplied this photograph in response to our request for something "all in the day's work."

Johnson & Phillips, Ltd.,

Electrical Engineers and Cable Makers since '75,

Charlton, LONDON. S.E. 7.

City Office—12, Union Court, Old Broad Street, E.C. 2.



Power for a Lincolnshire Ironworks.

Here we illustrate a contract which we have recently completed, and by which power is supplied to a well-known Lincolnshire Ironworks by means of Electricity conveyed to a distributing centre by underground cable, and distributed from thence by overhead lines.

Our illustrations show:—

(1)—*Cable being unreeled from one of the many drums conveyed to the scene of action by Motor Lorry.*

(2)—*Stretch of trench with cable laid therein.*

(4)—*Three E.H.T. Cables, paper insulated and lead covered suspended from steel catenary wires, supported on, steel structures, leaving the Power House and crossing over the sidings and beds where pig-iron is run out from melting furnaces.*

(6)—*The Three cables divided by steel structure seen in the picture, two continuing to the terminal pole of the overhead lines and the other leading off to the Pump House—*

(5)—*The Single Cable dipping down to and entering the Pump House, which lifts water from the reservoir.*

(3)—*The 6,000 volt line (with Earth wire and telephone lines below) which supplies power to the Pump House, the latter being built over the bore holes.*

and the manufacture of the Cables, together with the laying and erection, were executed throughout by us.

For such work our organisation offers exceptional facilities, and possesses a vast experience, concerning which all interested in Electrical Installations should enquire.

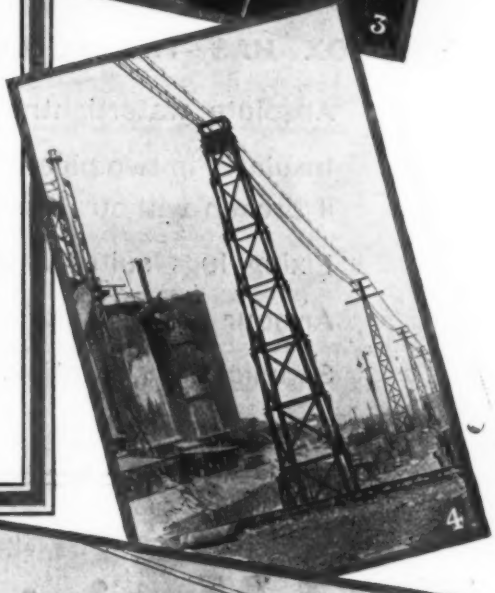
We invite such enquiries:—

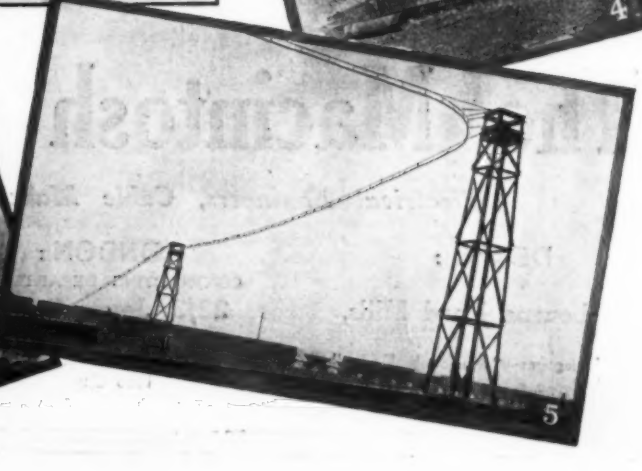
JOHNSON & PHILLIPS, LTD.,

CHARLTON, LONDON, S.E. 7.

City Office:—12, Union Court, Old Broad Street, E.C. 2.

Branches at—BIRMINGHAM, BRISTOL, CARDIFF, GLASGOW, MANCHESTER, NEWCASTLE-ON-TYNE, PORTSMOUTH, SYDNEY N.S.W.

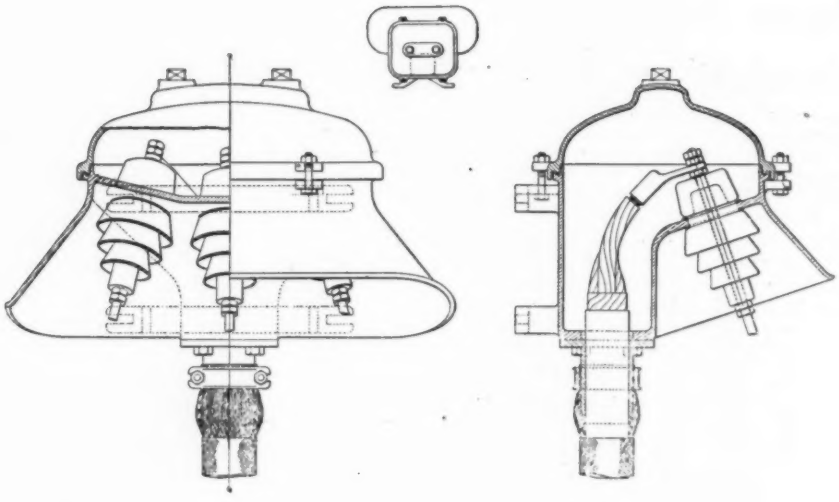




E.H.T. TRIFURCATING BOX

for

OUTSIDE USE.



THIS BOX HAS THE FOLLOWING FEATURES:—

Absolute watertightness.

Insulator in two pieces enables the outer portion to be renewed if broken without dismantling box.

Fixing lugs suitable for round poles or channel arms.

Armour clamp suitable for wire or tape armour.

Simplicity in erection.

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Electrical Engineers, Cable Makers and Contractors,

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Telegrams—"Macintosh, Derby."
Telephones—1200 Derby.

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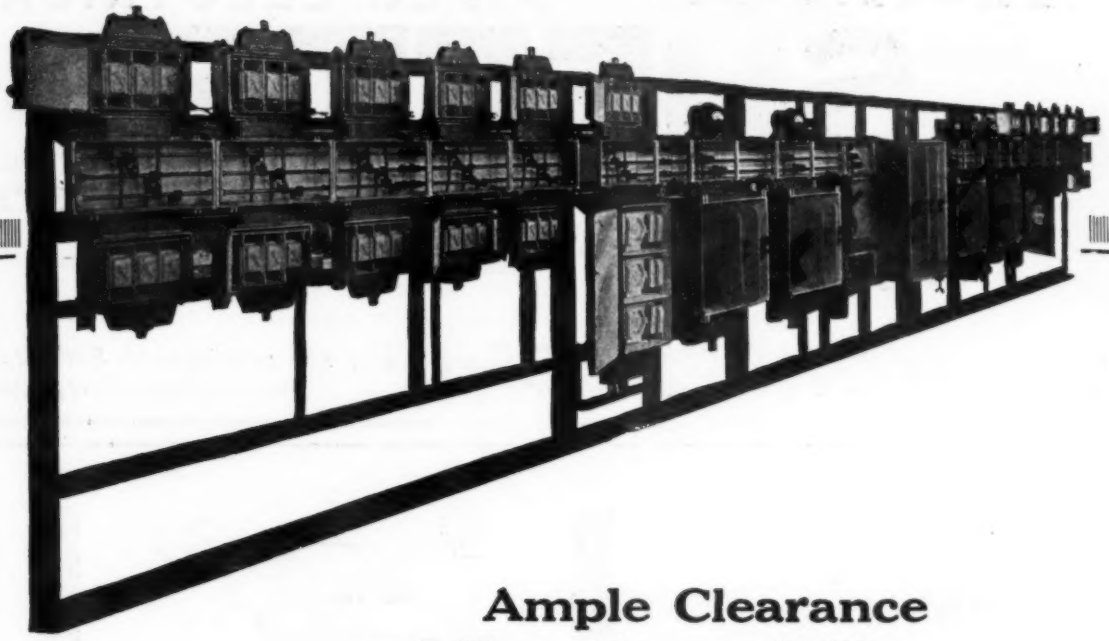
22/3, Jewin Street.
"Lark Barb."
1603 City.

LIVERPOOL:
Rice Lane, Walton.
"Conductor Liverpool."
73 Walton.



Ample Clearance and Easy Accessibility.

The above illustration is a photographic reproduction of a

HOPE'S PATENT

Fluvent

REGD. TRADE MARK

Power Centre Distribution Board

recently made and erected by us. Note the ample clearance and easy accessibility to all parts throughout.

It should always be remembered that the "FLUVENT" Distribution Board is built upon the Unit Principle (British Patent) with the Standard "FLUVENT" Switch Fuse for outgoing circuits; the incoming circuits taken in either through links, a large "FLUVENT" Switch Fuse or Oil Switch as preferred.

All Joints between the Unit System bus-bar chambers and switches are WATERTIGHT, the connections passing through cast-iron joint pieces. EXTRA UNITS can easily be added from time to time merely by moving the end covers.

ALL "FLUVENT" Switches are mounted on mica-covered steel rods, have parallel break, are guaranteed to stand 3,000 volts to earth for five minutes, and give an insulation test of 50 megs. Strongly made of mica, steel and china only, with all moving parts fitted with lock-nuts and split pins.

Write NOW for detailed information of the "FLUVENT" system, we cordially invite application for same.

Early deliveries guaranteed for Urgent or Special Orders.

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FOR Generators, Motors & Transformers.

MINIMUM CORE LOSSES.

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For Full Particulars and Prices apply to Sole Agents :—

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Lamps & Accessories

We have comprehensive stocks of Lamps and Accessories, and can despatch immediately reasonable quantities of Vacuum and Gasfilled Lamps, together with standard lines of Wiring Accessories. It would pay you to get details of our Stocks and Prices. Also obtain particulars of our offer to send our "Electrolux" Portable Cleaning Apparatus on special terms. The "Electrolux" is more compact than other Cleaners. The dust bag is *inside* the body and there are no revolving brushes.

M2

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BRANCHES: BIRMINGHAM—8, Church Street, Colmore Row.
DUBLIN—5, South Anne Street.
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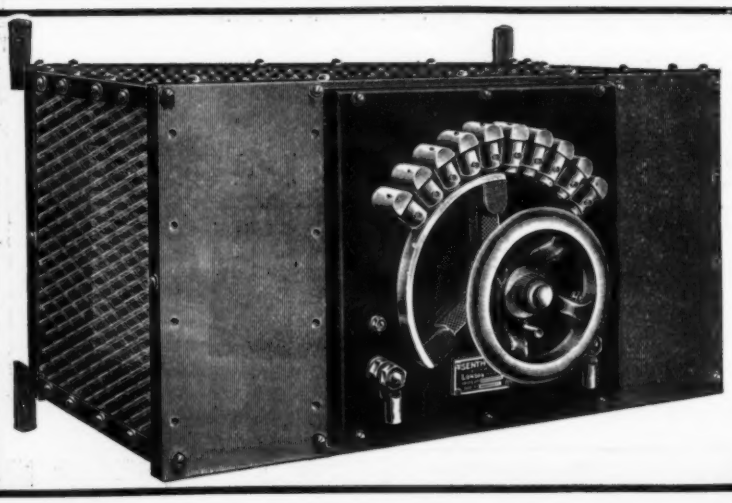

RHEOSTATS AND DIMMERS

for Incandescent or Arc Lamps of any capacity. Single or tandem types.

WE INVITE ENQUIRIES

ALSO FOR LOAD AND TESTING RESISTANCES.

Write (or 'phone Willesden 1488).

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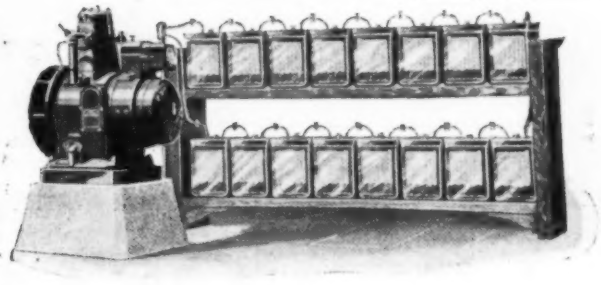
WILLYS

LIGHT & POWER SET

DEFINITELY "IMPROVES WITH USE"—
HAS A HIGH POWER AND A LOW PRICE—
IT IS THE MOST COMPACT AND PERFECTLY EQUIPPED MODEL
ON THE MARKET——————CONTRACTORS! SHARE OUR PROFITS

The KNIGHT SLEEVE VALVE ENGINE

More than half the
KNIGHT ENGINES
in the World are
WILLYS - KNIGHT



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NO WATER TANK.
NO BELT.
NO SWITCHBOARD.
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NO NOISE.
NO VIBRATION.
NO MAGNETO.
NO HIGH TENSION.
NO SPRINGS.
NO WASTE.
NO WEAR.
NO DANGER.

Brief Specification.

POWER	3 H.P.
WATTAGE	1¼ KW.
BATTERY CAPACITY	225 AMP. HOUR.
PRESSURE	30 VOLTS.
WEIGHT WITHOUT BATTERY	336 LB.
AVERAGE RUNNING COST PER WEEK	4/-
ENGINE SPEED	1350 R.P.M.
FLOOR AREA COVERED ENGINE	2 FT. SQ.
FLOOR AREA COVERED BATTERY	7.5 SQ. FT.

OIL AND FUEL SELF-CONTAINED.
AIR COOLED KEROSENE ENGINE.
DIRECT COUPLED SHUNT WOUND GENERATOR.
16 CELL BATTERY.

RETAIL PRICE COMPLETE £225.

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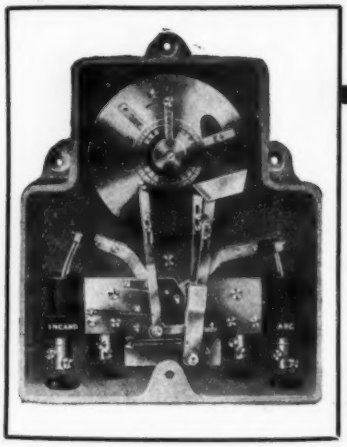
LONDON SHOWROOM - - - 151-3, GREAT PORTLAND STREET, W.1.
AGENTS - - - YOU WILL BE WHEN YOU READ OUR SALES PLAN.

WRITE TO-DAY FOR FULL PARTICULARS.

DON'T BLAME YOUR LAMP-LIGHTER FOR LATE RISING



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"The Switch that does everything—except fail."

The illustration is of a "DF" type, that switches on at dusk, changes over to half-night lamps when you will, and finally switches all off at dawn.

There is no programme too complicated for us to carry through.

Our catalogue is very detailed. Would you like a copy?

VENNER TIME SWITCHES LTD.
45 HORSEFERRY ROAD WESTMINSTER S.W.1
TEL. VICTORIA 4550. 'GRAMS. CLOXWICHES PHONE LONDON.

HEATRAE EF LTD NORWICH

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ELECTRIC BOILING RING.

PATENT APPLIED FOR.

REAL PROGRESS
in Boiling Ring Construction.

CHEAP——SUPER-EFFICIENT.

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SHOP LANTERNS and REFLECTORS,
Electrical Accessories,
METAL FILAMENT and
GAS FILLED LAMPS.

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REASON METERS.

OUR

THREE WINNERS.

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1-10 AMP. "STRAIGHT,"
250-500 or 1000 UNITS.

BECAUSE THEY ARE SUITABLE FOR

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BY CHOOSING THE RIGHT METER YOU

MINIMISE YOUR OUTLAY

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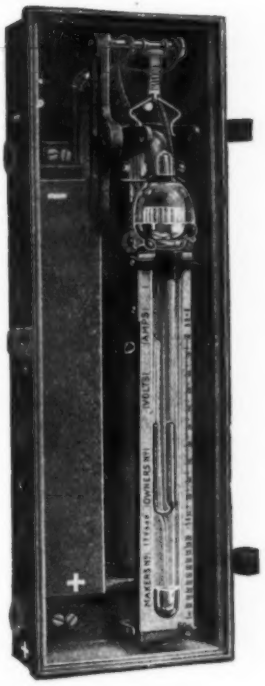

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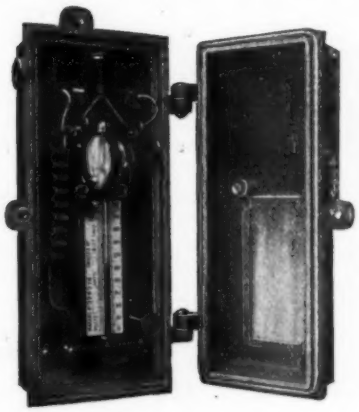
2000 UNITS.



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Works: **LEWES ROAD, BRIGHTON.**

Telegrams: "Reason, Brighton."

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ALSO MADE IN SIZES UP TO 1,000 AMPERES.

SPRING SUSPENSION—MAINTENANCE NIL—NO MOVING PARTS, WEAR, OR FRICTION—NO NON-STARTING LOSSES—VOLTAGE DROP LOW.

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Realising the value of display and demonstration the Company has arranged attractive and comprehensive exhibits at its Head Office, MAGNET HOUSE, Kingsway, London, W.C. 2, and at each of its numerous showrooms throughout the United Kingdom and abroad, where a magnificent variety of Electric light fittings and every other domestic electrical requisite may be inspected and explained to the greatest advantage.

The unique resources of these showrooms are placed entirely at the disposal of Contractors who may desire to send their clients for personal selection, whilst the policy of the Company provides efficient safeguards to the individual interests of the Trader.

Books of Showroom Introduction Cards are supplied to the Trade, post free on request.

(A1391)

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FOR SALE.

Advertisements are inserted under this heading at 1½. per inch.

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LARGE STOCKS ON HAND.

NEW Motors, Ironclad Switch and Fuse Gear, &c.
Hard Drawn Bare Copper Wires.
Cables and Wires.
Vacuum and Half-watt type and Automobile Lamps, Osram and Mazda makes. See below.

DELIVERY FROM STOCK.

New Hard Drawn H.C. Bare Copper Wires—
Nos. 8, 11, 4/0, 3/0, S.W.G., also ⅜ in. rod and 1 in. by 3/16 Copper Strip, at 9½d. per lb.
New Cables and Wires Insulated—

7/18, at £40 per mile.
7/16, at £69 per mile.
7/14, at £97 per mile.
19/20, at £57 10s. per mile.
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37/12, at £550 per mile.
3/22, at £13 per mile.
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Note.—Out prices are per mile and not per 1,000 yards.

Also sizes up to 91/11, and also 53/34 and 53/24 Three Core Cab Tyre.
The above Wires and Cables are "Glovers," "Henleys," "Hackbridge," "Callender's," and "Helsbys British Insulated" makes. Suitable quantities supplied.
255 miles 3/22, doubly taped, 2,500 meg. grade "Connolly," "Henleys," and "Callender's" make V.I.R. Wire, ¼ mile drums, £5 10s. each, drums free.
880 yards Black, or 440 yards of each Red and Black, on drums.
3/22, double taped ditto Wire, 15s. per 110 yards coil.
Galvanised Stranded Wires, 7/14, 4/8, and 7/8 gauges, also 7 and 11 gauge single ditto, 27s. 6d. and 25s. per cwt.

NEW MOTORS.

6-h.p. G.E.C., 220/240 V, 1,090 revs., £55 each.
9-h.p. G.E.C., 220/240 V, 840 revs., £85 each
10-h.p. Siemens, 220/240 V, 890 revs., £92 10s. each.
10-h.p. E.C.C., 220/240 V, fitted with reducing gear, from 850 revs. to 250 revs., £110 each.
15-h.p. B.T.H., 220/240 V, 845 revs., £120 each.
All the above new Motors are shunt wound and are complete with slide rails and pulleys.
New Direct Coupled Sets, E.C.C. make, shunt Motor, 1.65 h.p., 7.1 amps., Dynamo, .8-kW, 6/10 volts, 1,200 revs., with large polished slate switchboards fitted with necessary fittings. Price £90 complete per set.

NEW OSRAM AND MAZDA LAMPS.

We hold in stock approximately 200,000 Metal Filament and Half-watt type Gasfilled Lamps in their original wrappers as from the makers, in voltages from 25 volts, 230 volts.
Also 15,000 Automobile Lamps, 4 volt to 12 volt, all watts.
We allow special discounts of 45 per cent. off all Vacuum and 37½ per cent. off gasfilled new List Prices.
Also Ediswan Screwed Cap Osram Lamps, 220, 110, and 125 volt, 40 watts, ready for immediate delivery, 55 per cent. off new List Prices.
All lamps guaranteed.
A large stock of Ironclad Switch and Fuse Gear and Starters, also Ironclad Distribution Boards at greatly reduced prices.
Two-groove Porcelain Cleats, ½, 3/16, and ¼, at 6s. per gross pairs. Also large stock of other sizes, including Bobbin Cleats.
Quantity of Assorted Porcelain Leading-in Tubes.
Post Office pattern and h.t. Insulators at low prices.
Insulator Spindles, Wall Arms, and Corner Brackets.
We also hold a large stock of general Accessories by the best manufacturers, comprising D.P. and S.P. Switches, Distribution Boards, Volt and Amp. Meters, Conduit and Conduit Fittings, screwed and slip, Chatterton's Compound, Mica, Sheet Ebonite, and Fuses, all sizes.
Copper tubing, ⅜ in. up to 1 in. assorted gauges.
25,000 gross of Nettlefold's Screws, various sizes. All at clearance prices.
G.E.C. English Porcelain 5 amp. Wall Plugs, 18s. per doz.
5 amp. Cream Cut-outs, 6s. 6d. per doz.
Distribution Boards, in nicely polished hardwood cases, 3 and 4-way, at 3s. 3d. per way; 5-way, 3s. per way.
3½ in. Polished and White Enamel Blocks, 2s. 6d. per doz.
B.T.H. Quicklok Cleat Ceiling Roses, 9s. per doz.
Good quality imported Ceiling Roses, 5s. per doz.
Key Switch Holders, best quality, 19s. per doz.
20 amp. up to 100 amp. pure tin Fuse Wire, 2s. per lb.
Good quality ⅜ in. screwed conduit, 20s. per 100 ft., ½ in. ditto, 27s. 6d. per 100 ft.
New "Bellings," 3-heat, 2-pint Gluepots, 110-120 volts, 200 to 220 volts, with connections, 50s. each.
Desk Fans, 25 volt, d.c., slightly stock soiled only, guaranteed in good order, 40s. each.
New Combined Toasters with Cooking Utensils, 220 volt, 30s. per set.

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Established 1890. 'Phone: Hop. 2115. 6225

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New and Second-Hand, in Good Condition.

DYNAMOS.

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121	E.C.C.	50	110	720	S.
818	Westinghouse	135	220	300	C.
226	Peebles	495	220	300	S.
823	Phœnix	170	400	750	C.
315	Holmes	150	450/550	425	S.
441	Elec. Co.	200	480	350	C.
34	J. & P.	150	500	380	S.
860	Scott-Mountain	150	500	350	C.

ALTERNATORS.

Ref. No.	Make.	kw.	Phases.	Volts.	Revs.	Cycles
845	Westinghouse	80 (2 of)	3	200	250	50
414	G.E.C.	70	3	570	500	25
414	Do.	135	3	570	500	25
414	Do.	150	3	570	500	25
115	Do.	750	1	2000	277	60
423	Westinghouse	200	3	2400	300	50
840	A.E.G.	300	3	2500	350	50
805	Parsons	300	3	3000	3000	50
814	Westinghouse	300	3	3000	3000	50
830	Dick, Kerr	625	3	3000	1500	50
830	Westinghouse	300	3	3300	375	50

D.C. STEAM SETS.

Ref. No.	Make.	kw.	Volts.	Winding.	Steam Pres. lbs.
494	Browett-Jackson	15	100	S.	80
412	Belliss-B.T.H.	50	100/125	S.	150/160
847	Browett-Royce	30	105/110	C.	150/160
202	Willans-Siemens	15·9	110	S.	100
248	Sentinel-Verity	12	200/250	S.	60
830	Browett-Royce	250	210	C.	125
831	Browett-Royce	250	210	C.	125
301	Willans-Siemens	250	220	S.	120
843	Marshall-Cro'pton	350	220	S.	100
912	Ruston-Siemens	250	230	S. & C.	160
912	Ruston	310	230	S. & C.	160
912	Ruston-Crompton	550	230	S. & C.	160
504	Willans-Mather	50 (2 of)	250	S.	175
74	Belliss-W'house	140	250	S.	130
822	Barker-Mather	100	440	C.	200
830	Mather & Platt	132	440	S.	—
501	Belliss-Parker	150 (3 of)	440/525	S.	160
925	Belliss-Dick-Kerr	260	440/550	C.	130/160
926	Belliss-Crompton	450	440	S.	190
463	Belliss-Siemens	500	445/480	S.	150
665	Willans-Mather	324	450/550	S.	200
504	Do.	50	450/550	S.	175
504	Do.	150 (2 of)	460/500	S.	175
847	Belliss-Crompton	210/250	460/520	S.	150/160
870	Do.	100/120	500	C.	120
309	Belliss-Holmes	180	500	S.	150
236	Willans-E.C.C.	375	500	S.	180

PLANT LIST (COMPRISING STEAM SETS AND TURBINES, MOTORS, DIESEL SETS, GAS SETS, ENGINES, &c.), SENT UPON REQUEST.

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All Oil Immersed, Self-cooled for 50 periods supply.

No. Available.	KW. Capacity.	Phase.	Primary Volts.	Sec. Volts.	Make.
4	0.25	Single.	440	125	Morris Lister.
2	0.50	,,	440	,,	,,
2	0.75	,,	300/440	,,	Burnand.
10	1.00	,,	,,	,,	,,
1	2.00	,,	440	,,	,,
1	2.50	,,	400/440	,,	,,
5	2.50	Three	440	216.5	Brush.
2	2.50	,,	,,	220	,,
7	5.00	,,	,,	216.5	,,
9	6.25	,,	,,	217	,,
6	31.25	,,	,,	216.5	,,

All new and available for immediate delivery, with or without oil.

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ELECTRIC Motors and Dynamos.—Machines always available.
ARMATURES and FIELD COILS rewound or repaired without delay.

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FOR SALE.—*Continued.*

MYLAN & SMITH (Engineers), Ltd.,

SHEFFIELD.

ELECTRIC MOTORS. Best makes only. Many of them new, and all thoroughly overhauled and tested prior to despatch.

TWO PHASE, 50 PERIODS, 200 VOLTS (4-WIRE).

One 5-h.p., 1,450 r.p.m., squirrel cage.
One 10-h.p., 1,440 r.p.m., squirrel cage.
One 15-h.p., 710 r.p.m., squirrel cage.
One 16-h.p., 715 r.p.m., slip ring.
One 20-h.p., 720 r.p.m., slip ring
Two 30-h.p., 940 r.p.m., slip ring.
One 30-h.p., 580 r.p.m., slip ring.
One 40-h.p., 720 r.p.m., slip ring.

THREE-PHASE, 25 PERIODS, 400/440 VOLTS.

Eight 7½-h.p., 1,440 r.p.m., squirrel cage.

THREE-PHASE, 40 PERIODS, 400/440 VOLTS.

Two 7-h.p., 2,300 r.p.m., squirrel cage.
Three 7½-h.p., 760 r.p.m., squirrel cage.
Three 12½-h.p., 575 r.p.m., slip ring.
One 18-h.p., 760 r.p.m., squirrel cage.
One 20-h.p., 2,300 r.p.m., squirrel cage.
One 36-h.p., 580 r.p.m., slip ring.
Two 44-h.p., 760 r.p.m., slip ring.
One 48-h.p., 575 r.p.m., slip ring.
One 64-h.p., 580 r.p.m., slip ring.
Two 72-h.p., 760 r.p.m., slip ring.
Two 88-h.p., 580 r.p.m., slip ring.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

Twenty-four 4-h.p., 1,400 r.p.m., squirrel cage.
Twenty 6-h.p., 1,460 r.p.m., squirrel cage.
One 10-h.p., 385 r.p.m., squirrel cage.
One 12½-h.p., 715 r.p.m., slip ring.
One 36-h.p., 725 r.p.m., slip ring.
Two 44-h.p., 950 r.p.m., slip ring.
One 48-h.p., 725 r.p.m., slip ring.
One 64-h.p., 720 r.p.m., slip ring.
Two 72-h.p., 950 r.p.m., slip ring.
Two 88-h.p., 715 r.p.m., slip ring.
One 100-h.p., 480 r.p.m., slip ring.
One 250-h.p., 365 r.p.m., slip ring.

THREE-PHASE, 50 PERIODS, 500/550 VOLTS.

Three 16-h.p., 720 r.p.m., slip ring.
One 45-h.p., 720 r.p.m., slip ring.
Two 55-h.p., 950 r.p.m., slip ring.
One 60-h.p., 720 r.p.m., slip ring.
One 80-h.p., 720 r.p.m., slip ring.
Two 90-h.p., 950 r.p.m., slip ring.
Two 110-h.p., 715 r.p.m., slip ring.

DIRECT CURRENT, 220/240 VOLTS.

One 3-h.p., 740 r.p.m., compound wound enclosed ventilated.
One 5-h.p., 500 r.p.m., shunt wound, enclosed ventilated.
One 5-h.p., 700 r.p.m., compound wound, totally enclosed.
Forty-five 4-h.p. to 50 h.p., various speeds and types.

DIRECT CURRENT, 440/500 VOLTS.

One 5-h.p., 1,000 r.p.m., shunt wound, protected.
One 6-h.p., 800 r.p.m., shunt wound, protected.
One 10-h.p., 880 r.p.m., shunt wound, enclosed ventilated.
One 10-h.p., 1,200 r.p.m., shunt wound, protected.
One 15-h.p., 1,100 r.p.m., shunt wound, protected.
One 30-h.p., 750 r.p.m., shunt wound, enclosed ventilated.
One 36-h.p., 480 r.p.m., compound wound, semi-enclosed.
One 50-h.p., 630 r.p.m., compound wound, protected.
One 250 h.p., 485 r.p.m., compound wound, open.
One 450-h.p., 300 r.p.m., compound wound, open.

CRANE RATED MOTORS.

Thirteen 220 and 440 volt, series wound, totally enclosed crane rated Motors, 13 to 50 h.p.

Suitable control gear, slide rails, and pulleys are always available for the above machines.

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FOR SALE.—*Continued.*

R. O'BRIEN & CO.,

Wholesale Electrical Suppliers,

June 6th, 1921. 66, Mosley Street, Manchester.

Telephone Nos.:— Central 2273 & 7500.

Telegrams:— "Robanco, Manchester."

STOCK OF NEW D.C. MOTORS.

No. in Stock.	Type.	Maker.	H.P.	Volts.	R.P.M.	Pulley.	Rails.
2	Encl. vent.	E.C.C.	50	400/480	600	16 ×10	Yes
1	Encl. vent.	E.C.C.	40	400/480	600	15 × 9	Yes
1	Protected.	Siemens.	30	400/480	750	14 × 8	Yes
4	Encl. vent.	E.C.C.	30	400/480	750	14 × 7	Yes
1	Protected.	Siemens.	25	400/480	810	12 × 7	Yes
1	Protected.	Siemens.	25	500/550	810	12 × 7	Yes
3	Encl. vent.	E.C.C.	25	400/480	785	12 × 7	Yes
4	Tot. encl.	E.C.C.	20	400/480	850	14 × 7	Yes
2	Encl. vent.	E.C.C.	20	400/480	850	12 × 6	Yes
1	Encl. vent.	E.C.C.	15	400/480	1000	8 × 6	Yes
5	Encl. vent.	E.C.C.	10	400/480	900	8 × 6	Yes
6	Tot. encl.	E.C.C.	9	400/480	1000	8 × 6	Yes
5	Encl. vent.	E.C.C.	8	400/480	1000	6 × 4	Yes
8	Encl. vent.	E.C.C.	5	400/480	1000	6 × 4	Yes
1	Protected.	Siemens.	3	200/240	1450	5 × 4	Yes
7	Encl. vent.	E.C.C.	3	200/240	900	5 × 4	Yes
23	Encl. vent.	G.E.C.	2	200/240	1050	5 × 4	Yes
49	Encl. vent.	E.C.C.	2	200/240	1250	5 × 4	Yes
1	Encl. vent.	E.C.C.	1½	200/240	1000	5 × 4	Yes
18	Protected.	B.K.B.	1½	200/240	1500	4 × 3	No
19	Tot. encl.	Verity	1	200/240	1600	Yes	Yes
29	Protected.	Crompton.	1	200/240	1500	3 × 3	Yes
1	Protected.	B.K.B.	¾	200/240	1350	4 × 3	No
1	Protected.	L.	¾	200/240	1500	Yes	No
111	Protected.	B.K.B.	¾	200/240	1500	Yes	No
2	Protected.	U.	¾	200/240	2000	Yes	No

1, new, E.C.C., compound-wound, open protected type, interpole Generator, 30 kW, 220 volts, 950 r.p.m., with regulator, pulley and rails.

16 E.C.C. Cinema Reducer Sets, consisting of 2-protected type machines, motor, 340/380 volts, suitable for 400/480 volts, d.c. supply, 1200 r.p.m.; generator to give an output of 60 volts, 100 amps., complete with shunt regulator and double automatic starter.

6 ditto, 60 volts, 80 amps.

STOCK OF SECOND-HAND D.C. MOTORS.

1	Tot. encl.	Verity	3	200/240	1200	6 × 3½ Yes

1 Encl. vent., type E.C.C., compound-wound Motor, 150 b.h.p., 440 volts, 500 r.p.m., with pulley, rails and bedplate, two end shield type and two pedestal type bearings. Complete with starting panel.

1 Encl. vent., compound wound, interpole, L.D.M. Motor, 115 b.h.p., 460 volts, 600 r.p.m., with pulley and rails.

1 Protected type, B.T.H., compound wound, 6-pole interpole Generator, 52 kW, 220 volts, 650 r.p.m., with 14" pulley and rails.

STOCK OF NEW A.C. MOTORS.

Protected type, squirrel-cage, Star Delta wound Motors, 400/440 volts, 50 cycles, 3-phase, complete with rails.

Maker.				Pulley.
Verity	Two	20-h.p., at	950 r.p.m.	11 × 6
Verity	Two	13½-h.p. „	710 „	11 × 6
E.C.C.	Two	15-h.p. „	1000/955 „	8 × 6
E.C.C.	One	14-h.p. „	750/715 „	10 × 6
E.C.C.	Two	20-h.p. „	1000/955 „	10 × 6
E.C.C.	One	18-h.p. „	750/715 „	12 × 6
E.C.C.	One	24-h.p. „	1000/960 „	12 × 6
E.C.C.	One	24-h.p. „	750/720 „	12 × 7

E.C.C., 3-phase, protected type, 400 volt, 50 cycles, Slip Ring Motors, each complete with brush-lifting and short-circuiting device, slip-ring cover, two oil ring lubricated end shield bearings, standard shaft and pulley as specified below, complete with slide rails, standard terminal box with bushed cable holes, the slip-ring cover also having bushed cable holes.

No.	H.P.	R.P.M.	Pulley.
1	14	750/715	10 × 6
1	20	1000/960	10 × 6
1	18	750/715	12 × 6
2	24	1000/960	12 × 6
1	37	750/725	16 × 8
2	45	750/725	16 × 9
1	55	750/730	18 ×10

TERMS: Offered subject to being unsold. Cash with order. 777

NEW MOTORS. DELIVERY FROM STOCK AT LESS THAN MAKERS' PRICES.

SINGLE-PHASE, 50 periods, 100/200 V, twenty (¼ to 10-h.p.), Brook and Century.

THREE-PHASE, 50 periods, 400/440 V, thirty Parkinson. 1 to 20 h.p.

DIRECT CURRENT, 500 V, sixteen, by E.C.C., Scott, Siemens, and Bull.

Second-hand Motors, 3-phase, 440 V.

Direct current, 100 and 500 V, and single-phase, 100/200 V.

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FOR SALE.—*Continued.*

FOR SALE.

THE Guardians of the Ormskirk Union invite Tenders for the purchase of one 50-b.h.p. National Gas Engine, coupled to "Witton" Multipolar Dynamo, 220 V, 140 A, d.c., 230 r.p.m., which were installed at their Institution in 1914.

The above may be inspected, by appointment with the Master, Poor Law Institution, Ormskirk.

Tenders to be in my hands not later than 9 a.m. on TUESDAY, JULY 5th, 1921.

ALFRED DICKINSON,
Clerk to the Guardians.

Ormskirk.
June 15th, 1921. 6159

D.C. MOTORS.

FOR SALE, the following d.c. Motors, complete with Starters, excepting the 2-b.h.p. All in good running condition. Can be inspected by appointment.

No.	Volts.	B.h.p.	R.p.m.	Size of Pulley.	Make.
1	220	2	1150	Back-geared 6½" to 1½". Countershaft pulley. 3½" × 5" face.	Peerless Elec. Co., U.S.A.
1	220	¾	1250	2½" × 4" face.	Crocker Wheeler.
2	220	1	1675	Back-geared 4½" to ¾". Countershaft pulley. 5½" × 4" face.	" "
1	230	7½	1150	5½" × 6½" face.	Westinghouse.
2	220	¼	350 1000	2½" × 4½".	Peerless Elec.

6,163, ELECTRICAL REVIEW, 4, Ludgate Hill, London. E.C. 4

GREEN SILK-COVERED WIRE.

TENDERS are invited for approximately 3,800 lb. of Green Silk-covered Wire. To be cleared without reserve.

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ELECTRIC MOTOR REPAIRS.

ARMATURES and Field Coils rewound, new commutators supplied, temporary Motors loaned if required.

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NEW TURBO GENERATOR & SURFACE CONDENSING PLANT.

ONE 5,000-kW=6,250 k.v.a. Turbo Generator, 6,600 volts, 50 cycles, steam pressure 200 lb., superheat 250 deg. Fahr. Surface Condenser designed for Cooling Water inlet temperature of 80 deg. Fahr.

This Plant is practically completed in Maker's Works in England.

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500 volt, constant pressure Megger for sale, as new. Offers.

Twelve 96 amp.-hour Chloride Accumulators, as new, teak lead-lined cases, £2 each, or best offer for lot.

Two 10-way Desk intercommunication 'Phones, and one wall type, at 25s.

One 6-valve French Amplifier, £8 10s.

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DIRECT-COUPLED FOR PARAFFIN OR GAS.

50 kW Aster-Siemens, 110/220-220/550 volts d.c.

50 kW Aster-Siemens, 110/220-220/540 volts a.c., 3-phase, 50 cycle.

1 kW Petters-Boothroyd, 220 volts, 750 r.p.m.

All the above sets are brand new and complete with all spares, fuel and water tanks, switchboards, &c.

Also number of Searchlight Projectors with switchboards.

Full particulars, photos, and lowest prices from—

E. W. FARROW & SONS, Spalding, Lincs. Tel. 101. 5968

FOR SALE.

1,000 kW, comprising two Compound Engines, direct coupled English Manufacturing Co.'s compound wound, direct current Dynamos, 500 volts, 500 kW each.

Allen's surface condenser, 30,000 lb., with motor-driven air and circulating pumps. Excellent condition. May be seen running. Cheap.

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DIESEL ENGINES, six cylinder, two and four stroke, 850, 1,000, 1,200 H.P., excellent condition Dynamos for above 250 or 500 volts D.C. Immediate delivery and low price.

Also two 500-KW. Parsons Turbine Sets, 250 or 500 volts, D.C., with Condenser and spare armature.

Electrically-driven Air Compressors, 250 volts, D.C., pressures, 1,500 to 3,000 lb. per sq. in.

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Write for new stock list and state your requirements to—

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ONE 3-line Vertical Tandem National Engine, coupled to G.E.C., 440 volt, 500 kW Generator.

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Two 2-cylinder Horizontal Scavanging Premier Engines, coupled to 440 volt, 220 kW Bruce Peebles Generator.

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One 850-kW to 1,000-kW Gas Engine, direct coupled to Siemens Dynamo, 500 volts, together with complete producer Plant (full specification with drawings on application).

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THREE Sets immediately available. Capacity each 20,000 gallons per hour, against total "head" of 120 ft., complete with 25-h.p., 500 volt, d.c. Motors, and starting gear. Location London. Sold singly if required.

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15-h.p., 3-phase, 440 volts, 50 cycles, 720 r.p.m., squirrel cage.
40-h.p., d.c., 440 volts, 850 r.p.m.
15-h.p., d.c., 440 volts, 930 r.p.m.
12-h.p., d.c., 440 volts, 300/900 r.p.m., with Brookhirst panel.
5-h.p., d.c., 220 volts, 600 r.p.m., with Brookhirst panel.
7½-h.p., d.c., 220 volts, 750 r.p.m.
Many smaller sizes.
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FOR SALE by Private Treaty, the whole of the Machinery, Plant, Stock in Trade, and Letters Patent No. 140,903, and other effects of the Perna Engineering Works (Blackpool), Ltd.

The "Perna" Lighting Set (patented April 1st, 1919), suitable for Light Cars and Motor Bicycles, has already been placed on the market with satisfactory results.

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FOR SALE.

FOR SALE, 50-H.P., 440 volt, 3-phase, 40 cycle Bruce Peebles Motors, 760 revs., with Ellison Starters.

Plating Dynamo, 6 volts, 340 amps., by Scott & Mountain.

48-KW., 220 volt, compound Generator.

15 and 22-H.P., 220 volt, D.C. Motors, with Brook Hirst Starting Panels.

100/120 volt, 110 amps., shunt wound bi-polar Dynamo, with ring oiled bearings.

DRUMMOND & Co., Middlesbrough. 321

FOR SALE.

MODERN ELECTRIC GENERATING PLANT.

75-kW, 500 volt, d.c., compound Set.
140-kW, 500 volt, d.c., triple expansion Set.
130-kW, 230 volt, d.c., compound Set.
225-kW, 220 volt, d.c., compound Set.
200-kW, 460/500 volt, d.c., compound Set.
420-kW, 460/500 volt, d.c., compound Set.
700-kW, 500/550 volt, d.c., triple expansion Set.
850-kW, 460/500 volt, d.c., turbo Set.
1,000-kW, 220 volt, d.c., geared turbo Set.

Also a number of 3-phase, 25 and 50 cycle Turbo Alternators up to 1,500 kW. and several Vertical Gas Engine Sets from 100 to 500 kW, 440 and 500 volts d.c.

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MOTORS.—IMMEDIATE DELIVERY.

FULL range of d.c. Motors from ½-h.p. to 30-h.p. All standard voltages in stock. For immediate delivery.

Full guarantees Attractive prices.

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½, 1, 3, 5, 7½, 10, 15, 20, 25, 30, 40, and 50-H.P., 400/440 volt, 3-phase, 50 cycle.

3, 5, 7½, 10, 15, 20, 25, and 40-H.P., 480/530 volt, D.C.

We are able to offer special terms for these Motors ex stock.

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MAKER'S Guarantee—stock replaced as sold.

Squirrel Cage.		Slip Ring.
1, 2, 3 and 4 H.P. 950 and 1440 R.P.M.	SINGLE PHASE.	5, 6, 7½, 10 and 15 H.P. 950 and 1440 R.P.M.
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Several good S.H. Motors at attractive prices. 6126

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CABLES.

PAPER-INSULATED, Lead-covered, and Armoured.
.1 to .6, 3-cored, Low Tension.
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.1 to .6, Single Low Tension.
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All guaranteed new by leading maker.

Write in first instance to 6214, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

VARIOUS ELECTRICAL PLANT FOR SALE.

Special Opportunity.

MOTOR GENERATORS.

Ref. 912—500 kW Crompton S t, on combined bedplate 230/210 volts, 460/470 volts, complete with starters for starting either side.

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D.C. MOTORS.

Ref. No.	Make.	H.P.	Volts.	Revs.	Winding.
705	Laurence Scott	75 (3 of)	220	420	S.
705	Do.	75 (3 of)	220	420	C.
215	Lancs. Dynamo	150	220	450	S.
910	Westinghouse	50 (2 of)	400	600	C.
914	Lancs. Dynamo	110	460	650	C.
910	Mather & Platt	50	500	275	S.
910	Westinghouse	60 (2 of)	500	600	S.
910	B.T.H.	80	500	600	S.

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TRANSFORMERS AND MOTORS FOR SALE.

THREE 500-kW. oil cooled Transformers, 10,750/425 volts, 3-phase, 50 periods, by British Electric Transformer Co.

Two 100-kW, oil cooled Transformers, 6,600/220 volts, 3-phase, 25 periods, by Brush Electrical Engineering Co.

One 50-kW, oil cooled Transformer, 440/110 volts, 3-phase, 25 periods, by Johnson & Phillips.

One Motor Converter, 110 volts, 25 periods, to 12 volts, 20 amps., by Crypto.

MOTORS, 3-PHASE, 440 VOLT, 25 PERIODS.

Five 40-h.p., slip-ring, Westinghouse, 720 r.p.m. Motors.
Two 35-h.p., squirrel cage, 725 r.p.m. Motors, by G.E.C.
One 30-h.p., slip-ring, 725 r.p.m. Motor, by G.E.C.
One 5-h.p., slip-ring, 500/477 r.p.m. Motor, by Siemens.
One Motor Generator, 3-phase, 440 volts, 25 cycles to 8 volts, 40 amps., mounted on bedplate, by Rhodes, Ltd.
One 200-h.p., slip-ring, Westinghouse Motor, 485 r.p.m.
One 160-h.p., slip-ring, B.T.H. Motor, 480 r.p.m.
Twelve 60-h.p., slip-ring Motors, by Westinghouse, 485 r.p.m.
Thirty 25-h.p., slip-ring, Westinghouse Motors, 720 r.p.m.
Three 20-h.p., slip-ring, Westinghouse Motors, 720 r.p.m.
Ten 10-h.p., squirrel cage, Westinghouse Motors, 710 r.p.m.
Nine 5-h.p., squirrel cage, Westinghouse Motors, 480 r.p.m.

MOTORS, 3-PHASE, 440 VOLTS, 50 PERIODS.

One 100-h.p., slip-ring, 720 r.p.m. Motor, by Fuller.
One 50-h.p., slip-ring, 950 r.p.m. Motor, by G.E.C.
One 7½-h.p., squirrel cage, 950 r.p.m. Motor, by Harding Churton.

MOTORS, 3-PHASE, 220 VOLTS, 50 PERIODS.

Four 5-h.p., squirrel cage, 975 r.p.m. Motors, by Brook, with starter (new).

MOTORS, 500 VOLT, D.C.

One 100-h.p., compound interpole Motor, 585 r.p.m., by Westinghouse.

MOTORS, 480/440 VOLT, D.C.

One 3½-h.p., shunt interpole, 950 r.p.m., by Newton, Ltd.
One 5-h.p., shunt interpole, 1,075 r.p.m., by Bruce Peebles.
One 10-h.p., shunt interpole, 1,075 r.p.m., by The G.E.C.
One 15-h.p., shunt interpole, 840 r.p.m., by Newton, Ltd.
One 20-h.p., shunt wound, 1,150 r.p.m., by G.E.C.
One 40-h.p., shunt interpole, 550 r.p.m., by J. P. Hall, with Brookhirst starter.

MOTORS, 220/250 VOLT, D.C.

One 60-h.p. Motor, by Rees Roturbo, Ltd., Wolverhampton (Thomas Parker), protected type, compound interpole, 210 volts, 640 r.p.m., new 1916.

One 30-h.p. Motor, by British Westinghouse Co., protected type, compound interpole, 220 volts, 600 r.p.m., new 1917.

One 24-h.p. Motor, by Royce, Manchester, protected type, shunt, speed 1,000 r.p.m.

One 20-h.p. Motor, by Morris Hawkins, 750 r.p.m.

One 12-h.p. Motor, by B.T.H. Co., totally enclosed, pipe ventilated, compound interpole, speed 800 r.p.m., new 1918.

One 9-h.p. Motor, by G.E.C., protected type, shunt interpole, 840 r.p.m., as new.

One 7½-h.p. Motor, by B.T.H., shunt interpole, 1,100 r.p.m.

One 4½-h.p. Motor, by B.T.H., protected type, shunt, 1,700 r.p.m.

Two 3-h.p. Motors, by Verity, shunt interpole, totally enclosed, 1,200 r.p.m., as new.

MOTORS, 100/110 VOLTS, D.C.

One 12-h.p., series wound, 850 r.p.m. Motor, by L. D. & M. Co.

One 5.75 shunt interpole, Westinghouse, 1,000 r.p.m., coupled to 3-in. Rotary Pump on C.I. bedplate.

One ½-h.p. shunt wound, 1,000 r.p.m., by Verity.

Two 1-kW, shunt wound Generators, direct coupled to 700 r.p.m., high-speed Steam Engine, by Robey.

DYNAMOS, 110 VOLTS.

Two 10-kW, compound interpole, by the E.C. Co., 1,000 r.p.m.

One 20-kW, compound interpole, by Westinghouse Co., 450/500 r.p.m.

CABLE.

385 yds. 7/14 Twin Concentric L.T. Paper L.C. & A., new on drum, by Western Electric Co.

126 yds. .75 sq. inch Sough Core Paper L.C. & A., new on drum, by Western Electric Co.

Most of the above machines are complete with pulley, switchgear, and rails. Guaranteed in excellent condition and equal to new.

SWITCHBOARD PANELS.

Forty Panels, 6 ft. by 2 ft. by 2 in., with 1,200 amp. D.P. Circuit Breakers and Ammeters, by B.T.H. Co., new 1918.

One Panel, with 3,000 amp. D.P. Circuit Breakers and Ammeters.

Watt-hour Meter, 230 volts and 2 S.P. 3,000 amp. Knife Switches.

THE MIDLAND COUNTIES ELECTRICAL ENGINEERING CO., LTD.,
136, Sandon Road, Birmingham.

Telegraphic Address: "Rheostat, Birmingham." 6143

FOR SALE.— *Continued.*

FOR SALE.

PETROL-ELECTRIC Generating Sets. Ex-Government stock. Coventry-Simplex, Keighley-Kelvin, and Gardner direct coupled sets, output 100 amp, 80 volts, complete with Switchboard equipment. Practically new. Ideal for kinemas, or any power or lighting. Will run full load on about ½ gal. of petrol per hour. All 10 kW. Cost about £800 to build. Only 20 sets left. £185 cash at Liverpool.
HUGHES, Co-operative Hall, Liverpool. 2460

Advertisements are inserted under this heading at 1s. 9d. per line.

A.C. and d.c. Motors (second-hand), switch plates, switchboards. —The Isis Electrical Co., 57, Albert Road, Aston, Birmingham. 2477

A LARGE Stock of surplus Plant for disposal in France; turbo-alternators; Diesel and steam engines; transformers; rotary converters; motors and generators. Very low prices owing to present rate of exchange. Apply to Alex Lefebvre, 9, Rue Arsène Houssaye, Paris (8e). 1816

A.C. Motors, single-phase, 110 and 220 V, 50 per., 1400 r.p.m., Crypto, £20; 200 V, 100 per., 1400 r.p.m., 2 h.p., Crypto, £20; 3·6-h.p., 200 V, 50 per., 1400 r.p.m., Crypto, £32 10s.; 220 V, 50 per., 5 h.p., 1400 r.p.m., Crompton. £40.—White, 140, Southwark Street, S.E. 2444

BATTERY Charging Dynamo, 50/70 V, 14·2 A, 1000 r.p.m. £22. —Giffen, St. Albans. 2366

BRITISH-Thomson 940 kVA, 3 phase, 50 cycle, 500 V, turbo alternator for immediate disposal.—Alex. Lefebvre, 9, Rue Arsène Houssaye, Paris (VIII). 2060

CROSSLEY Town Gas Engine, 8½ cylinder, with Fielding gas plant for same; also 14-kW, 140 V dynamo for sale. Best offer accepted.—Scen Electricity Works, Wadebridge, Cornwall. 2483

DYNAMO, first class, and with spare armature, 33 kW, 220/240 volts, 133 amperes, 850 r.p.m., four pole, compound. Cheap. —Chick & Co., Skin Market Place, Southwark. 5897

DYNAMOS, 55 V, 12 A, 1000 r.p.m., shunt, by City Elec. Co., £11 10s.; G.E.C. £12 10s.—White, 140, Southwark St., S.E. 2442

DYNAMOS, 110 V, 32 A, 1430 r.p.m., by G.E.C., £27 10s.— White, 140, Southwark Street, S.E. 2443

EARTHING Clips, in copper, all sizes, ½" to 2" in stock, three types of terminals, our own make. Write for trade sheet.— Isaacson & Brown, Ltd., 39, Furnival Street, Holborn, E.C. 4. 5368

ELECTRIC-Driven, high-lift, multi Stage Pumps, capacity up to 600 ft. head, at 140 gals. per min.; can be coupled to two 35-h.p., 500-volt, d.c. motors, or two 40-h.p., 440/500-volt, a.c., 3-phase, 50 cycles, slip-ring Motors; brand new.—Harry H. Gardam & Co., Ltd., Staines. 4138

ELECTRIC Motors and Dynamos for sale or hire, d.c. and a.c. Machines always ready, guaranteed.—'Phone: 488 H'smith. The Electro-Generator Co., 1a, Shepherd's Bush Road, W. 6. 2464

FOR SALE.—About 8 miles New Henley's 3-core Paper-insulated, Lead-covered, and Armoured Low-tension Cable, from ·05 to ·6 sq. in.—The Phœnix Electrical Co., Ltd., 32-36, Broomielaw, Glasgow. 6200

FOR Sale, Dynamos, 12 volt, 8 amp., full automatic for battery charging. Best British make guaranteed. Compound cut-out, ammeter, four switches, connection box, and pilot light. Polished aluminium cover, plug and pulley. Ready for use. £6 10s., cash with order. Lucas, 12-volt batteries, in wood case, with plug. 45s. each. Motors, ½-h.p., by Stone, of Deptford, 12 volt. £4 5s. each. H.T. Magnetos, for pressure testing or ignition, one or two sparks per rev. M. L. Coventry make. 35s. each. Brass Hand Pumps, for Junction Box Pits, 10 in. long, brass disk valves. 15s. each, cash with order. Dept. E, Leslie Dixon & Co., 91, Queen Victoria Street, E.C. 4. 5067

FOR Sale, Electric Lighting Set, by Lister & Co., size E, 110 Volts, complete with engine, dynamo, battery, and switchboard gear—never been used. Owner prepared to accept any reasonable offer.—Henry Lea & Son, Consulting Engineers, 38, Bennetts Hill, Birmingham. 6174

FOR Sale, New Henley Cable, at 25 per cent. less than maker's price, 3 and 4 core, lead-covered, armoured, paper-insulated, low-tension, all sizes from 12½ to 600 amperes. State requirements. —6177, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, one Crypto Dynamo, 100 volts, 10 amperes, 1400 revs., 12-in. pulley, in good condition. Makers No. 28,210, Type 210. Offers invited.—Secretary, Swindon Victoria Hospital, Swindon. 2465

FOR Sale, one 10 h.p. second-hand Motor, 715 r.p.m. 3-phase, 50 cycle 400/440 volt, complete with pulley, slide rails, and starter; one 5 h.p. ditto, 700 r.p.m.; one 7½ h.p. ditto, 955 r.p.m.; one 5 h.p. ditto, 1400 r.p.m. All in absolutely first-class condition at bargain prices.—W. P. Young & Co., 40, Sanvey Gate, Leicester. 5003

FOR Sale or Hire, Motors and Dynamos, 440, 220, 110 volts.— Martin, 320, Witton Road, Birmingham. Phone: East 883. 1470

FOR SALE.—*Continued.*

FOR Sale, owing to alterations to purchaser's scheme, one new 5-tons 3-motor electrically-driven overhead travelling crane, 220 volts, d.c. Motors can be changed to suit other supply if required. Immediate delivery. Also, for delivery in three weeks, 3 2-tons Electric Pulley Blocks with 400 volts a.c. motors.—Full particulars and prices from makers, S. H. Heywood & Co., Ltd., Reddish, near Stockport. 6204

FOR Sale, three 250 h.p., 440 volt, 50 cycle, 3-phase, 365 r.p.m., slip ring induction motors by British Thomson-Houston Co., Ltd. Complete with control gear, price £940 each.—The Phœnix Electrical Co., Ltd., 32-36, Broomielaw, Glasgow. 5215

FOR Sale, totally-enclosed d.c. Motors; brand new. One 5-h.p., 440 volts, 1050 r.p.m. One 9 h.p., 440 volts, 1050 r.p.m. by Veritys, Ltd., Ashton. Also two motors, as above, direct-coupled to Multi-Vane Fans, by Messrs. Keith & Blackman.—R. F. Winder, Belgrave Electrical Works, Leeds. 6178

FOR Sale, two 100- b.h.p. protected-type, slip-ring Motors, fitted with brush-lifting and short-circuiting device, wound for 220 volts, 50 periods, single-phase, 950 r.p.m., with belt pulley, 21" dia. by 18" face, with protected-type stator starter, and protected-type rotor switch and resistances, oil immersed, and slide rails and holding-down bolts.—9538, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 47-kW, 400-volt, a.c., 3-phase Generator, 25 frequency, 375 r.p.m., complete with 6-groove rope pulley; makers, J. P. Hall, Oldham.—2454, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, two 35-kW. Bellias-Siemens 200/300 Volt shunt wound steam dynamos, with spare armature and switchgear. These sets are in first class condition, and just taken out of service.—6175, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 190-kW Motor-Generator, by General Electric Co., Ltd., 460/500 volts d.c. to 50/75 volts, 25 cycles, single-phase, 500 r.p.m., complete with switchgear, &c., £790.—Phœnix, 32, Broomielaw, Glasgow. 5794

INDUCTION Motors, ¼ to ½ h.p., 100/200 volts, 50/100 periods, one, two or three phase, £10.—H. Cecil Green & Co., 85, New Oxford Street, London. 6131

LALLEY Light, model "F," complete with battery; all as new; used for demonstration purposes; £100.—Giffen, St. Albans. 2367

LARGE number of 1 kW Dynamos, 25/37 Volts, 1900 r.p.m., £16 10s.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, Cannon Street, E.C.4. 6222

MOTOR Blowers or Air Circulators, by Keith Blackman, direct coupled to 220-volt motors, £9 each. 12 ammeters, N.C.S. portable, wood case and strap, 5 and 10 amps., at half-price. Anemometers, electrical indicating wind speeds 0-50 m.p.h., 40s. each. Three Foster Pyrometer Instruments, leads and sockets. Inert dry batteries, square, Siemens, 9s. per dozen. Enamelled Steel Shades 5s. per dozen. Cardboard Shades 3s. dozen. Electric Drilling Machines £15 each, subject. 12-volt Battery Dynamos £6 10s. each.—Leslie Dixon & Co. (Dept. E.), 91, Queen Victoria Street, E.C. 4. 5971

MOTOR-Generator, suitable for 220-volt supply, 960 r.p.m., output 11 kW, 50/100 volts, by the Lancashire Dynamo and Motor Co., complete with elaborate switch panel; cheap.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, Cannon Street, E.C. 4. 6221

MOTORS.—A number of new and second-hand Machines, by first-class makers, both a.c. and d.c., ranging from 2 to 45-h.p., for disposal. Low prices for prompt cash.—Full particulars on application, Tofield & Robinson, Ltd., 165, Edmund Street, Birmingham. 6120

NEW Motors and Starters. Cheapest firm on earth. Try us.— Cunningham Limited, 171, Edgware Road, W. 2. 640

ONE 1·25-kW petrol-electric Generating Set, comprising "Kelvin" engine, Bosch magneto, carburettor, direct coupled to 25/37-volt generator, 34 amps, 1000 r.p.m.; combined bedplate; nearly new; £55.—Gann, Builder, Whitstable. 2379

ONE Tangye Town's Gas Engine, 13 H.P., two flywheels and Silencer. Good as new, £120.—2502, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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PLATING Dynamo, by Oppermann, 6 V, 50 Amp.; perfect order, just overhauled; £17 10s.—Landor Works, Landor Road, London, W. 12. 2475

QUANTITY of 50-volt, 70-amp., 3½-kW Petrol and Paraffin Electric Generating Sets, either direct coupled or belt driven. Other sizes in stock, ½ kW, 1, 3, 4, 5, 6, 7, 8, 10, &c., up to 50 kW.— Fyfe, Wilson & Co., Ltd., 31, Budge Row, Cannon Street, E.C. 4. 6219

SECOND-HAND Dynamo, 100/140 volts, 62 amps., 970 r.p.m., with shaft extension for coupling or pulley. Perfect order. Offers.—Mann, Egerton & Co., Ltd., 39, Princes Street, Ipswich. 6164

SIX 10-b.h.p. Bruce Peebles, 240 volt, d.c., variable speed Motors, 725/1450 r.p.m., with pulley, rails, shunt series tramway type controllers (new machines).—Apply Mitchell Graham & Son, Ltd., 56, Bucclench Street, Edinburgh. 2451

FOR SALE.—*Continued.*

THREE Siemens 150 h.p. Electric Motors, 250 volts, modern multipolar interpole type, 400 revs.—Details, Harry H. Gardam & Co., Ltd., Staines. 5395

THREE 15-kW, 230-volt Gardner-Newton petrol-paraffin Generating Sets, 750 r.p.m. £250 each, including switchboard and all accessories. Perfect condition, guaranteed.—Smith Brothers, Aylestone Park, Leicester. 5830

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TWO 2-Throw Belt Driven Ram Pumps, by Peam, plungers 8½" × 10" stroke, 11,000 gals. per hour at 200 ft. head. Weir boiler, feed pump, new 1915, 2,500 gals. per hour, 180 lb. pressure.—Harry H. Gardam & Co., Ltd., Staines. 6191

TWO 60-h.p. Petter Crude-oil Engines and two 39-kW 220-V Dynamos. Will sell very cheap for quick sale.—Chick, Skin Market Place, Southwark. 6185

TWO Boiler Tanks, 20' × 6', for oil or benzine storage, £85 each. Electric 10-ton Light Railway Tractor, 2' gauge, complete with charging dynamo and switchboard.—Particulars and prices on application, Hammond & Bottomley, 33, Mackenzie Street, Slough. 'Phone 272. 2340

TWO 4 h.p. Motors, 1250 r.p.m., 220 Volts, shunt wound, new, £30.—Fyfe, Wilson & Co., Ltd., 31, Budge Row, Cannon Street, E.C.4. 6223

TWO 21-kW Petrol-Paraffin Electric Generating Sets, complete with 50-amp. 50-volt Booster in tandem.—Fyfe, Wilson and Co., Ltd., 31, Budge Row, Cannon Street, E.C. 4. 6220

TWO 75-kW E.C.C. Generators, 220 volts, 780 r.p.m., makers Nos. 27434 and 6, shunt interpole, outside bearing, baseplate, slide rails and pulley. £275 each, f.o.r. Used as motors, 90 H.P. at 700 R.P.M.—Smith Brothers, Aylestone Park, Leicester. 5829

2/3½-kW, 110 V, Austin-G.E.C., in first-class order. Cheap to clear.—Giffen, St. Albans. 2369

2-H.P., 230-V Motor, 1190 r.p.m., by Siemens, with starter, £24. Giffen, St. Albans. 2368

7½-H.P. Phœnix Motor, 3-phase, 190/220 volts, 50 cycles, 1450 r.p.m., with starter (new), £48; another nearly new, £38.—Gann, Builder, Whitstable. 2380

12 VOLT Battery Dynamos; electrical drilling machines at half cost; petrol-electric sets 50 volt 1½ kW, £30 each: armoured 1/16 gauge, 600 megohm cable, £5 per mile drum; torpedo wing lamps, 20s. pair; enamelled steel shades, 5s. 6d. per dozen; electric fans d.c. 40s. each; flexible shafts in casings 2s. per foot.—Leslie Dixon & Co. (Dept. E.), 91, Queen Victoria Street, E.C. 4. 6059

12-VOLT Dynamos, self-regulating or plain shunt, various types from stock for battery charging, prices from £5 10s. each; ammeters, moving coil, sub-standards, in wood case with strap, 45s. each; motors, 12-volt, ¼-h.p., 85s. each, ½-h.p., 100s. each; electrical anemometers to 55 m.p.h., 35s. each; Foster pyrometers, £7 each; square inert batteries, by Siemens, 6s. and 9s. per dozen; enamelled steel shades, 8" and 10", 60s. per gross; cardboard shades, green, 36s. per gross; electric bench and portable drilling machines, brand new, £15 each; direct coupled petrol-electric sets, 1½ kW, 50/70 volts, £30 each; 1/16 gauge V.I.R. armoured 600 megohm cable, £5 per mile drum; torpedo side lamps, 20s. per pair; d.c. fans, 8 volts and 220 volts, 40s. each; flexible shaft and coupling casing for light drills, 10s. 6d. each; brass hand pumps, 15s. each; H.T. magnetos, as new, 35s. each; black adhesive tape, 1s. per lb.; portable 12-volt batteries, from 45s. each.—Leslie Dixon & Co., (Dept. E), 91, Queen Victoria Street, E.C. 4. 6231

15-H.P. Motor, 500 volts d.c. 1500 r.p.m., complete with starter, slide rails, pulley, and circuit breaker. As new, £68.—F. Greathead, Bar Street, Scarborough. 6206

25-B.H.P. Ruston Engine, Gas Plant, 100 to 160 volts, Allen dynamo, driving belt; all in first-class condition. A bargain, f.o.r.—Fowler, 219, Tottenham Court Road, London. 2473

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30-H.P., on town gas, horizontal twin Crossley. Practically new; has not done nine months' work. Is the last word in gas-engine construction. With all accessories and perfect.—Chick & Co., Skin Market Place, Southwark. 5632

32-H.P., two-cylinder, Allen vertical Oil Engine. Direct coupled to a 100/140 volts dynamo. All accessories. This set runs perfectly.—Chick & Co., Skin Market Place, Southwark, S.E. 1. 5633

35-H.P. on suction gas, Crossley, with gas plant to serve same, all accessories, in perfect order.—Chick & Co., Skin Market Place, Southwark, S.E.1. 5631

FOR SALE.—*Continued.*

40 N.H.P. Loco Type Boilers (three), by Robey, excellent condition. Insured 105 lb. w.p., examined since left off work.—Harry H. Gardam & Co., Ltd., Staines. 6188

50 H.P. Electric Motor, semi-enclosed four-pole type, slow speed, 440 volts, d.c., also 55 h.p. ditto by Siemens, 3 bearings.—Harry H. Gardam & Co., Ltd., Staines. 5397

50-kW Belliss-Siemens modern 110-V, d.c. Lighting Set, compound H.S. steam engine coupled to multipolar generator.—Full details and price, Harry H. Gardam & Co., Ltd., Staines. 4127

60 B.H.P. Crude Oil Engine, by Blackstone, variable fuel governing, latest type, single flywheel, new about 1915. 50 h.p. horizontal paraffin or crude oil Engine, by Ruston, P.Q. type, condition like new.—Harry H. Gardam & Co., Ltd., Staines. 6190

£75 MOTOR, 15 h.p., 440/500 volts, compound, 1100 revs. enclosed ventilated Morris Hawkins, rails, pulley, and starting panel; perfect running order. £65, Motor, 12 h.p., 440/500 volts, shunt wound, 600 revs., enclosed ventilated Bruce Peebles; perfect running order.—2495, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

100-KW Belliss-P. R. Jackson Steam Generating Set. 220/250 volt, 160 lbs. steam.—Halliwell & Good, Ltd., 61, High Street, Manchester. 6170

100-kW new d.c. Generator, 230 volts, enclosed interpole type, available immediately.—Harry H. Gardam & Co., Ltd., Staines. 5396

100-KW., d.c. Generator, 500 V, direct coupled to Belliss and Morcom steam engine, available immediately for quick sale at bargain figure.—Richards, Stafford House, Trentham Road, Longton. 6072

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200 KW, 460/500 volt, steam set, "Belliss" compound engine No. 4325, coupled to shunt interpole generator by Phœnix Dynamo Mfg. Co., Ltd., price £1,350.—The Phœnix Electrical Co., Ltd., 32-36, Broomielaw, Glasgow. 6064

400-kW 500-volt "Belliss" Steam Set, with Surface Condenser, Pumps, &c. Purchaser to remove.—6201, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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3000 YARDS of 3 core high-tension cable, 7/15 gauge, 3000 volts, lead covered, steel tape armoured, taped and compounded, second-hand, but in perfect condition. In lengths of about 200 yards; 10s. per yard.—Bernard Meggitt, Mansfield. Tel. 224. 6212

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OPPORTUNITY for Consumers of Electrical Cable to acquire an interest in an up-to-date manufacturing company with well-equipped works.—Apply, Whitehill & Whitehill, Chartered Accountants, 35, Waterloo Street, Birmingham. 6169

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WHOLESALE Electrical Business for sale as a going concern. Stock approximately £800. Excellent fittings and fixtures. Two years under term of lease still to run. Rent £52 per annum.—For further particulars apply to Liquidator, Parkin S. Booth 2, Bixteth Street, Liverpool. 6127

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To Telephone Factors, Shippers and Electricians.

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THE ASSETS AUCTIONS CO., LTD.,

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On Wednesday, June 29th, at 12.30 prompt,

Government Surplus Telephones and Electrical Stores,

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On view day previous and morning of sale. Catalogues upon application. 'Phone Hop 3862 and 748. 6202

SITUATIONS VACANT.

Latest Time for receiving, 5 p.m. Wednesday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

NATIONAL ASSOCIATION OF SUPERVISING ELECTRICIANS.

ALL Employers in the Electrical Industry requiring really capable Supervisers, Estimators, or Foremen, should notify their requirements to the Hon. Secretary of the above Association, as under.

All applicants for membership are admitted solely on their qualifications, which must bear the strictest investigation.

HON. SECRETARY.

Room 29, Metropolitan Buildings,
63, Queen Victoria Street, E.C.4. 5907

ROYAL AIR FORCE.

RECRUITS for the following trades required. Power Station Engineers, Shift Engineers, Engine Drivers and Dynamo and Switchboard Attendants for 4 years' service. Ages: Civilians, 18 to 28; ex-Service men, 18 to 38. Marriage allowance paid to married men of 26 years of age and over.

Call or write, Inspector of Recruiting, 4, Henrietta Street, Covent Garden, W.C. 2, or R.A.F. Recruiting Depot, 298, Bath Street, Glasgow. 5970

SHIFT ENGINEER.

SHIFT ENGINEER required at the Eccles Corporation Electricity Works. Must have good electrical and mechanical experience. Salary in accordance with National Joint Board Schedule (present rate being £314 1s. 11d. per annum).

Applications, stating age, experience, when at liberty, &c., with copies of recent testimonials, to be forwarded forthwith to the BOROUGH ELECTRICAL ENGINEER, Electricity Works, Cawdor Street, Patricroft, Lancs. 6176

ARMATURE WINDER.

GOOD a.c. and d.c. Winders required immediately for repair work. None but first-class men need apply to—

W.M. ENGINEERING CO., 6, Fleet Street, Dublin. 2455

SITUATIONS VACANT.—*Continued.*

IPSWICH CORPORATION ELECTRIC SUPPLY AND TRAMWAYS.

Appointment of Chief Engineer and Manager.

THE CORPORATION invite applications from fully-qualified Electrical Engineers for the above position. The gentleman appointed will be responsible for the control of the following Undertakings and Branches:—

THE ELECTRIC SUPPLY UNDERTAKING.—D.c., d.c. Traction, and 3-phase a.c. (h.t. and l.t.) supplies. Present capacity of Power Station 6,000 kW. A second 3,000 kW Ljungstrom Set is now in course of erection. Total sales for year ending March 31st last 5,464,955 units.

THE INSTALLATION DEPARTMENT. (Providing installations for lighting, power, &c.)

THE ELECTRIC VEHICLE GARAGE DEPARTMENT. (Garage for 35-40 vehicles.)

A SEPARATE REFUSE DESTRUCTOR WORKS.

THE ELECTRIC TRAMWAYS UNDERTAKING, including the upkeep of the permanent way. There are 10.8 miles of route and thirty-six cars.

The total number of employés was 400 on March 31st.

The salary will commence at £900, rising to £1,200 by annual increments of £50. The gentleman appointed will be required to devote the whole of his time to the duties appertaining to the position. He will be required to plan and carry out extensions in connection with either Undertaking as they become necessary, and he must possess a wide experience in such work. He must be a Corporate Member of the Institution of Electrical Engineers, and have already held a responsible position in connection with an up-to-date Electric Supply Undertaking.

Applicants should state age, details of experience, how soon they could take up appointment (the date should be September 1st, if possible), and should submit copies of not more than three recent testimonials.

Applications must reach the undersigned not later than JULY 18th, 1921.

Canvassing in any form will disqualify.

WILL. BANTOFT,
Town Clerk.

Town Hall,
Ipswich. 6213

EAST INDIAN RAILWAY.

Electric Power Station Superintendent (Grade 2).

THE DIRECTORS are prepared to receive applications (by letter only) from duly qualified candidates for appointment to the above post in India.

Candidates should be about 30 years of age, and must have served a trade apprenticeship with an electrical firm of good repute, and have subsequently gained good experience in the erection and running of electric power stations generating and distributing electrical power in the direct current and alternating current form. Good experience on the steam side is essential. Candidates must furnish full particulars of their training and experience.

Salary, Rs. 525 per calendar month, rising by annual increments of Rs. 25 per month to Rs. 600, and subsequently to Rs. 650 per month.

Terms: A four years' agreement, with free passage out and home on satisfactory termination of engagement.

Candidates must state their age, and if married, the number of persons in their family for whom living accommodation is necessary.

The selected candidate will have to pass a strict medical examination by the Company's Consulting Physician before appointment.

Letters of application, which should be accompanied by copies only of testimonials, Army discharges, &c., must be addressed to the undersigned not later than JULY 6th, 1921.

By order,

G. E. LILLIE,
Secretary.

East Indian Railway Company,
28-30, Nicholas Lane, London, E.C. 4.
June 20th, 1921. 6203

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ASSISTANT Engineer to works engineer wanted at large engineering works. Must be capable organiser and able to undertake control of small drawing office, and preparation of all details in connection with works extensions and layouts.—State age, experience (fully), previous positions held, and salary required, to 6181, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A VACANCY occurs in a large provisional supply undertaking for a Constructional Electrical Engineer. Good knowledge of electrical detail and modern e.h.t. switchgear. Salary £500 per annum.—Apply, stating references, to 6192, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A YOUNG Armature Winder required; must be able to wind car-lighting dynamo armatures fields and cut-outs and other small armatures. Smart improver considered. State all particulars, if Union, and wages required, to 2456, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

DESIGNER.—Vacancy occurs with firm North of England, for designer a.c. and d.c. plant, up to 150 h.p. Must have had previous experience.—Apply, stating salary and full qualifications, 6142, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN (temporarily for 6 months or longer) required with mechanical and electrical experience. One with knowledge of power station lay-out essential.—Reply, stating age, married or single, full particulars of education and experience and salary required, to General Manager, Northampton Electric Light and Power Co., Ltd., 25, Bridge Street, Northampton. 2335

DRAUGHTSMAN, with shop experience and accustomed to instrument and switchgear work, wanted in neighbourhood of London. Give fullest particulars of experience, also state age and salary required.—2461, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer required who can work out and develop the windings and manufacture of small electric motors, transformers, and instruments. Good opening for smart young man.—2459, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER.—Power Plant Engineer wanted for large engineering works in the North. Applicants must have had sole charge of a municipal or industrial power station. Only men who can prove their ability to reduce operating costs, and maintain same at a minimum, will be considered.—Applications should state age, full particulars of experience, and salary required, to 6182, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER.—Wanted by firm of switchgear manufacturers in Manchester district a first-class Engineer, fully experienced in design of all classes of switchgear apparatus, lay-out systems and modern protective gear. Must also be able to prepare estimates for large installations. Only really capable men who have held responsible positions in similar capacity considered.—State age, experience, training, and salary required, to 6146, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN for tramway and generating station workshop. Permanent position to suitable man. Wages, subject to revision with engineering trade, £6 per week.—Apply, with copies of references, to Rhondda Tramways Co., Ltd., Rheola Road, Porth, Glam. 2462

FOREMAN required to take charge of department in large telephone works. Complete knowledge of manufacture of all types of G.P.O. cords essential. One with experience of tinsel manufacture preferred.—Reply, stating age, experience, and salary desired, to 6049, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN required to take charge of department in large Telephone Works. Complete knowledge of manufacture of all types of G.P.O. Cords essential. One with experience of tinsel manufacture preferred. Reply, stating age, experience, and salary desired, to 6207, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

INDIA.—A firm of Electrical Engineers and Contractors in Calcutta require the services of a competent engineer, age not over 32, single, with thorough knowledge of d.c. and a.c. work, conversant with steam and oil engines; good prospects to right man. Rs. 600 per month to commence, five years' agreement.—Write, giving details of experience, age, and send copies of testimonials to Z. X., 731, c/o Deacons, Leadenhall Street, E.C. 3. 2428

INSTRUMENT Inspector, also fully qualified tester, wanted.—State fully technical knowledge and experience, type of instruments examined, age and salary required, to 2453, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JOINTERS required with experience of e.h.t. cable jointing. Only first-class men need apply, giving full particulars of experience and wages required, to 6057, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGERS Wanted, for Electrical Contracting Department.—Mann, Egerton & Co. have vacancies in London and the provinces. Sound commercial and technical training and experience essential, particularly as regards country house installations and factory equipment. Duties comprise general control, estimating, inside and outside organisation and supervision, initiation of new business, and the attainment of prompt and efficient service.—Applications (in confidence) with scheduled particulars of previous experience, copies of two recent references, and photograph (if possible) to "R.," Mann, Egerton & Co., Ltd., 21, King Street, Norwich. 6211

POWER Station, Tramcar and Omnibus Rolling Stock Superintendent required for an extensive company system in the Midlands.—Apply, giving full particulars of experience, to 6167, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

REQUIRED, by well-known manufacturers of ironclad switchgear, Representative, commission only, already having connection south and south-east coasts.—2467, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SALESMAN.—Representative wanted for the Midlands with good electrical engineering knowledge, capable of advising buyers and securing business. Preference will be given to man with sound connection. Applicants must state age, experience, and qualifications. If testimonials are enclosed, only copies should be sent.—6180, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

SECRETARY required for small Electric Lighting Company in West of England. Will be required to undertake general clerical work. Write, stating salary, 2481, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant required, with experience of d.c. three-wire system. Experience with accumulators an advantage. 48 hour week. State wages required, and when disengaged.—6218, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TRAVELLER for London and suburbs required by Wholesale Electrical firm. Small salary and good commission. State experience and terms.—6232, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TRAVELLER to handle side line; good commission. Samples weigh few ounces. State ground covered.—Box C. S. 3152, c/o Haddon's Advertising Offices, Salisbury Square, E.C.4. 6160

TRAVELLERS required to sell, upon commission only, very high-class enamelled and other insulated magnet wire, also all classes of special electrical conductors and moulded ebonite. Must have connection with large users and factors. Respective districts to be covered: Lancashire and Yorkshire, Newcastle and district, Glasgow and district, Birmingham and district, Bristol and South Wales. State fully experience and lines at present handling.—6224, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Commutator Builder, used to railway traction armatures (London district).—6051, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Driver with experience of Diesel and gas engines, able to undertake running repairs. 48 hour week. State wages required, and when disengaged.—6217, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, energetic Commercial Engineer as Sales Manager, by London manufacturers of electrical instruments and heating appliances. Must be technically and commercially qualified.—Apply, stating age, experience, training, and remuneration required.—6187, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

COUNTY Borough of Croydon (Shift Charge Engineer).

SITUATIONS WANTED.

MINISTRY OF LABOUR.

The Proprietors of the ELECTRICAL REVIEW have placed this space at the disposal of the District Director, Ministry of Labour, 3 and 4, Clement's Inn, Strand, W.C. 1, to whom all replies should be addressed, quoting number of advertisement, the date on which it appeared, and the name of this paper.

ELECTRICAL Engineer.—Age 23, single. Magneto expert and general electrical engineering. Tracing and correction of faults in car electrical equipment. General workshop practice. (52,964).

TRAINING Vacancy required in Mechanical Engineering. Age 25, Lieut., had two years' technical training Engineering Institute. Desires to complete. (52,767).

TRAINING Vacancy required in Electrical Engineering. Age 25, C.S.M., had 12 months training Sterling Telephone and Elec. Co., and 4 months theoretical training Science School, Dublin. Desires to complete. (70,503).

ELECTRICAL Engineer.—Age 24, single. Assistant Electrical Engineer. Mains department. Sub-station. Experience in 1100-V, 3-phase transforming down to 200-V for general supply. Laying of mains, and supplying light and power to consumers. Testing installations. (3538/21)

ELECTRICIAN or Motor Car Electrical Improver.—Age 21, single. City and Guilds Certificate. First-class magnetism and electricity, first-class telegraphy, and second-class telephony. Three years' experience in G.P.O. engineering department. Seven months as inspector in loading coil department of electrical company. (99,679.)

MANAGER Electrical firm.—Age 58, married. Naval Officer. 23 years' experience as assistant and general manager of electrical supply company. (356,944.)

ELECTRICAL Instrument Fitter and Wirer.—Age 22, single, Experience of Wireless Telegraphy with Mercantile Marine (54,328.)

WIRELESS Telegraphist.—Age 28, married. Two years' experience as above. Good knowledge of I.C. Engines, (53,745.)

SITUATIONS WANTED.—*Continued.*

MECHANICAL and Electrical Engineer.—Age 35, married. Motor Engineer, R.N. Served 2 years' apprenticeship to tramway company. Seven years' experience as Charge Engineer tramway company; six years as Chief Superintendent municipal tramways in South Africa. Thorough knowledge construction and maintenance of I.C. Engines, steam engines, turbines, &c. Willing to go abroad. (1451/21.)

ELECTRICAL Engineer.—Age 33, married, 2nd. Lieut. A.M.I.C.E. A.I.E.E., fluent French, Portuguese and Danish; three years' as pupil to cable company, going through all shops, five years' experience as outside superintendent, cables and overhead work. Ten months' experience erection of machinery and construction of works and starting production of light railway tracks, &c. (97,016.)

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A CAPABLE Electrician, Foreman or otherwise. Out of London preferred. Good testimonials. 22 years' experience with plants, power, motors, telephones, house and factory wiring, estimating.—6, Bickerton Road, London, N. 19. 2458

ACTIVE Electrician (Mechanical), generating plant, motors, wiring (all systems), complete installations, overhead, mains, country house, factory, institutions, seeks situation anywhere.—Morris, Lynchmead, Winscombe, Somerset. 2354

A DISABLED ex-Soldier (24), seeks situation, Storekeeper, &c., or would learn a trade, something in the electrical line. Good references, willing worker. Pre-war over two years' electric lighting and fitting. — 2324, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (25), ex-service, seeks situation as electrician-improver or mate, used to lighting and bells. Good references.—2486, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, seeks situation as chief draughtsman, 20 years' experience, mechanical and electrical with leading firms. Reasonable salary.—2327, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, disengaged, 20 years' practical electrical experience, seeks progressive position, assistant manager, superintendent, progress, supervising, commercial, general, extensive experience in buying for large combine. — 2311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (19), practical and technical, City and Guilds exams., use to manufacture of switchboards, X-ray coils and apparatus, rectifiers, electric clocks, &c.—H., 202, Totterdown Street, Tooting. 2337

A FIRST-Class Electrician, charge or otherwise; references.—4, Squires Lane, Finchley. 2338

ALL-round Wireman, 20 years' experience, wants job, new installations or maintenance, charge or otherwise; nine years with suburban supply company.—"Electrician," 256, High Road. Willesden Green. 2494

AN Electrical Engineer ("Batti Wallah"), age 32, wants situation with prospects; all-round experience; initiative, organising ability, not afraid of work; non-Union; excellent references.—2370, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrician, plant, wiring, engines; any job; anywhere.—71, Kenthouse Road, S.E. 26. 2406

AN Improver seeks situation anywhere; age 18; three years' experience.—C. Averham, Gerrards Cross. 2297

A PRACTICAL Engineer and Electrician, 20 years' experience with d.c. dynamos, motors, 2 or 3 wire system, Lancashire and Babcock boilers, high speed engines, pumps, and auxiliary plant, gas and paraffin engines. Three years as charge engineer in municipal undertaking; can do all mechanical and electrical repairs, not afraid of work, will accept any position; age 39.—2253, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder (Improver), 4 years' experience, seeks engagement.—2449, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder, all types, repairs, maintenance, breakdowns.—J. E. K., 20, Kempshead Road, Camberwell. 2413

ARMATURE Winder; good experience, good references. Distance no object. Eight years' all-round armature experience, a.c., d.c.; rewinds, repairs. Age 22. Would consider offer abroad.—A. Playbe, Myrtle Villa, Heybridge, Essex. 2484

ASSISTANT Electrician, wants work, power, lighting and 'phones, five years in the trade.—2493, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BUYER or Manager, first-class commercial experience, shop and drawing office training, wide knowledge, used to detailed work, &c., desires change; age 40.—2372, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COMPETENT Electrician-Mechanic seeks situation, wiring, all systems, repairs, power and private plants, charge or supervise, machine repairs, good references. — 2332, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

ELECTRICAL and Mechanical Engineer employed with large contracting firm, requires spare time employment in a consulting or other capacity where his experience would prove useful. —2476, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and telephone Engineer, with 30 years' experience seeks position in an installation contractors as manager or supervisor, used to all wiring systems and country house work.—2402, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (experienced), maintenance, power, lighting, installation, lifts.—"Electrician," 61, Grand Parade, Harringay, N.4. 2342

ELECTRICAL Engineer, now unemployed, is willing to prepare drawings and drafts for patents. Ordinary drawings and tracings; or to carry out any engineering work. Reasonable terms asked.—2415, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, age 27, disengaged, experienced in switchgear, motors and power installations, has thorough technical and practical knowledge and speaks Portuguese and Spanish.—2393, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (G.I.E.E.), thoroughly trained (technically and commercially), many years' city experience, desires important and trustworthy position; fully conversant with motors a.c., d.c., &c., home and foreign buying and selling markets well known, possessing initiative, tact, exceptional administrative qualifications, and a gentleman of good address.—2423, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Fitter, Winder and Electrician, also lifts; 20 years' experience; references.—E. S., 34, Furnan Avenue, Walthamstow. 2403

ELECTRICIAN, all-round wireman, power and plant work, years experienced.—"Electrician," 31, Mason Street, Reading. 2404

ELECTRICIAN disengaged. All branches, charge or otherwise.—Martin, 69, Vant Road, Tooting, S.W. 2440

ELECTRICIAN, energetic, h.t., a.c., and d.c. power plant running and erection, switchboards, lighting, bells, &c. Age 22. Accept £5 per week wages.—2487, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, competent and reliable mechanic seeks maintenance or other job.—"Electrician," 1, Crossley Terrace, N. 7. 2489

ELECTRICIAN, good reference, power, lighting, and 'phones, new installation or jobbing.—2492, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, lighting, power, alarms, signs; any distance.—Robertson, 26, Rosebank Grove, Walthamstow. 2419

ELECTRICIAN seeks employment, maintenance or installation work. Any distance. — Salmon, 22, Stepney Green Dwellings, E. 2421

ELECTRICIAN, wiring all systems, motors, testing. Charge if required.—T. B., 6, Listria Park, N.16. 2429

ELECTRICIAN, thorough knowledge and experience, all descriptions erection, maintenance work. Good references.—6, Tachbrook Road, Southall, Middlesex. 2400

ELECTRICIAN, practical and technical, seeks engagement, experienced in a.c. and d.c. work, country house plant, 'phones, &c.; 12 months motor test bed. Ex-corp. R.E., pre-war experience, aged 28; good references.—Burden, 14, Rosenthal Road, Catford. 2320

ELECTRICIAN, country house plant work, lighting or power; highest references.—"W," 81, Seventh Avenue, Manor Park, E.12. 2239

ELECTRICIAN, experienced; first-class references; anywhere —146, Westmoreland Road, Walworth. 2319

ELECTRICIAN, 12 years' experience (age 29), used to general contracting work, screwed tubing, plant work, &c.—E. C., 13, Moselle Avenue, Wood Green, N. 22. 2303

ELECTRICIAN wants job. Power and lighting, a.c. and d.c. Good all round. 14 years' experience. Go anywhere.—2457, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, wireman, wants work. Lighting, power, maintenance, &c.—G. S., 46, Mayton Street, N.7. 2469

ELECTRICIAN-Wireman, competent all branches, country house work, plant and repairs.—J., 44, Chichester Road, Tonbridge. 2373

ELECTRICIAN-Wireman, good all-round hand, 20 years' experience, good refs.—D., 4, Rossetti Gardens, Chelsea. 2339

ELECTRICIAN-Wireman, plant and installation work, anywhere. —B. J. S., 20, Clarence Road, Tottenham, N. 15. 2352

ELECTRICIAN, 21 years' experience, power, A.C. and D.C., lighting and telephones. References.—2346, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, thoroughly competent power, 'phones, lighting, overhead line construction; experienced with gas and oil engines: age 26; seeks responsible situation, home or abroad.—44, Belgrade Road, Stoke Newington. 2343

SITUATIONS WANTED.—*Continued.*

ENGINEERING Publicity.—Fully trained electrical engineer (32), versed in theory and practice, journalism, and all details of engineering publicity, is open to receive offer for services.—2427, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER and Works Manager, A.M.I.E.E., 1st class B. of T certificates, 18 years' experience h.t. modern London power istaton (five years as station superintendent), at present works manager of large expanded metal works in Western area, is desirous, for personal reasons, of returning to London district. Open to accept responsible position in either power station or manufacturing branch. Excellent testimonials from well-known power-station engineers. Exceptional experience in organising work, costs and handling men.—2381, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER-Draughtsman, young ex-Service, used to design of rheostats, general electrical apparatus; workshop experience; references.—Odom, 8, Manor Gardens, Richmond. 2474

ENGINEER. Remarkable contracting and commercial experience, seeks responsible post, preferably commercial. London or abroad.—2360, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, Electrical, Mechanical and Sales, 12 years' experience. Five years Royal Engineers. Thorough knowledge Rectifiers. Requires responsible position where hard worker with initiative is essential. First-class references.—2325, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FIRST-Class Engineer-Electrician, maintenance and erection, motors, lifts, &c., a.c and d.c., seeks permanency. Charge of instal ation preferred.—2463, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

HAVING had the experience of Oil firing in U.S.A. would be willing to fill situation.—Percy Gilbert, Treeve, Hayle. 2418

IMPROVER, electrical experience in all branches, age 27, disengaged.—E. Pratt, 65, Holly Park Road, New Southgate, N. 11. 2500

IMPROVER, used to all class of conduit tubing, wiring, four years' experience.—2497, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

IMPROVER (20), just completed apprenticeship with dynamo and motor manufacturers, excellent reference, small repair shop preferred.—2308, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MAINTENANCE Electrician, thorough experience, seeks re-engagement.—Beveridge, 15, Delamere Terrace, W.2. 2416

MAINTENANCE or any other capacity. Who requires energetic man? 24 years. Late telephone factory and maintenance inspector. General electrical knowledge.—2501, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MILLWRIGHT Electrician, 16 years' experience, wants work; large experience of power and factory maintenance, machinery repairs, &c. Top hole references. Low rate.—170, Standen Road, Wandsworth, S.W. 18. 2491

METER Repairer, 16 years' practical experience, with C.C., A.C. phase, and slot meters. Good electrical knowledge, excellent references. Age 38.—F. M., 12, Pentney Road, Balham, S.W. 12. 2350

ORGANISATION, Secretarial, &c. Young man (33) desires change. (A.C.I.S.). Book-keeping and accountancy, commercial and company law, shorthand &c. Expert organiser. 13 years' first-class experience with leading electrical engineers.—2488, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PLUMBER-Jointer, experienced, disengaged, seeks progressive employment.—2316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SALES Manager (or assistant). Good organiser; up-to-date commercial and technical experience. Reasonable salary. Would go New Zealand or Canada.—2470, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SMALL Premium to apprentice youth (17), 18 months' experience with electrical engine ring firm.—M., 47, Glebe Road, Hornsey, N.8. 2450

TRAMWAY Smith, Fitter, used truck work bearings, shoeing.—Howard Groves, Staple, Canterbury. 2480

WIREMAN wants job. Any system.—Robinson, 5, Agincourt Road, Hampstead, N.W. 2351

WIREMAN, all branches, wants work.—4, Seaton Street, N.W.1. 2420

WIREMAN'S Assistant (20), four years' experience, requires situation. Disengaged.—Brooks, 16, Thornhill Road, N.1. 2436

WIREMAN disengaged. Experienced all branches—lighting, power, telephony, erection and maintenance. Go anywhere.—MacGregor, 53, Brewster Gardens, W. 10. 2482

WORKING Foreman (age 39), control extensive high-class contracts and maintenance, lighting, power, heating, telephones, fire alarms, bells, cranes, hoists, electric vehicles, complete country plants testing, fault finding, rectifying, estimate labour and materials, and prepare entire schemes, mansions, hospitals, cinemas, factories, paper mills, &c. London, country or abroad.—2353, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

YOUNG Engineer, age 22, with 5½ years' practical, mechanical and electrical workshop experience, and with solid technical training, desires Junior Position with electrical engineer. Low salary until ability proven. Ripe for specialisation. London preferred, though not essential.—For particulars, write 2392, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

YOUTH (18½) requires sit; 4 years' mechanical and electrical experience. Willing.—R., 17, Linden Avenue, N.W. 2411

AGENCIES.

Advertisements are inserted under this heading at 1s. 9d. per line.

LAMP AGENCY.

ONE of the oldest British Electric Lamp Companies, manufacturing both Carbon and Metal Filament Lamps, has vacant the district comprising the Counties of Norfolk, Suffolk, Cambridge, and part of Essex. Applications (which will be treated confidentially) from representatives having good trade connections, should be forwarded to—
6042, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

AUSTRALIA.

MANUFACTURERS desiring Connections and Trade are invited to communicate with W. G. WATSON & Co., LTD., Electrical Engineers and Merchants, 279, Clarence Street, Sydney, N.S.W. Cable Address: "Switchon, Sydney." London Representatives: MURRAY-COOMBES & RICHARDS, 150, Southampton Row, W.C. 1.

Manufacturers desiring

REPRESENTATIVES IN AUSTRALIA

are invited to communicate with:—

H. ROWE & Co., Electrical Engineers and Importers,
Head Office: 507, Flinders Street, Melbourne,
Australia. 6230

A FIRM of Electrical and Mechanical Engineers, recently reorganised, established for over 16 years, having extensive connection in Scotland, with offices and warehouses in Glasgow, desire additional agencies preferably cable, motors, conduit, switchgear and heating appliances.—2472, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCY.—The Victoria Electrical Co., of 27, Berry Street, Manchester, sole agents for the British Empire of V.E.C. Dutch made half Watt type and drawn wire lamps are prepared to appoint agents in all principal towns of the United Kingdom. Exceptional terms. Corporations, large consumers, and factors supplied from stock. Write for particulars. 2250

AGENCY Required for South Wales to represent well-known manufactures of Ironclad Switchgear. Only applicants who have already established connection can be considered.—2468, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENT wanted in Lancashire for moulded insulators, must be first-class man with good connection in electrical trade.—6186, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENTS wanted to represent an old-established Firm manufacturing Overhead Electric Travelling Cranes, Electric Telphers, Monorail Hoists, Pulley Blocks, Winches, &c. Countries available for allotment to representatives of good connection: Norway, Sweden, Russia.—Full particulars to 6210, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREIGN Agencies or Agents quickly obtained by advertising in foreign papers.—Rates, &c., from Deacon's British and Foreign Advertising Agency, 7, Leadenhall Street, London, E.C. 3. 5846

METALLIC Filament Lamps.—Established firms wanted to act as distributing agents in every county in Great Britain. Firms appointed will be granted sole agency in their respective counties.—Write Z. Y. 754, care Deacons, 7, Leadenhall Street, E.C. 2471

SOLE London Agencies for electrical goods, required by experienced representative.—Howard, 42 Braxter Park, Streatham, S.W. 2499

TURN your spare time into cash. Organize local sales of a speciality for power users.—A., 128, Junction Road, N. 2498

ARTICLES WANTED.

Advertisements are inserted under this heading at 1s. 9d. per line.

A.C. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. Learoyd & Son, Bridge Works, Heatherley Street, Clapton, N.E. 1775

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone: Dalston 2278; Telegrams: "Frangible, Lowclap, London," buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable Scrap Metals, Metallic Drosses, &c., &c. Inquiries solicited. Established over 50 years. 1776

ARTICLES WANTED.—*Continued.*

D.C. Generator wanted, 350 kW, 440 volts, 340 r.p.m., 3-phase, 50 cycles. State type, condition and price.—6046, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PLATINUM Scrap wanted for cash; the highest market price given. Call, or parcel by post, prompt cash by return.—L. Stern, Rotunda Buildings, 5, Bold Street, Liverpool. 2241

REQUIRED, bridge-megger, post office pattern, complete with resistances.—6128, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, two sets each 250 to 300-kW, 220 volts, d.c., with Belliss or Browett engines.—Particulars and price to Walker, 2, Oswald Street, Glasgow. 6099

WANTED, Electrical Sets, all sizes, boilers, accumulators dynamos, motors, &c.; also scrap cable and metals. Complete plants purchased.—Williams & Sons, 37, Queen Victoria Street, London, E.C. 4. Telephones: 3938 City and 834 Hop. 8574

WANTED, good second-hand Alternator, 400 V, 2-phase, 50 periods, about 40 to 60 kW; either belt-driven or direct-coupled to steam or oil engine.—All particulars, stating lowest price and where can be seen, to 2466, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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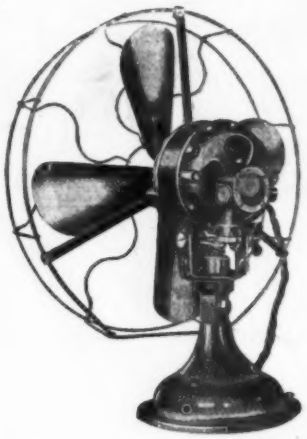

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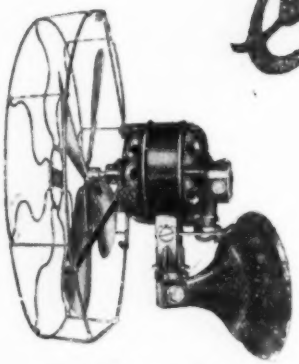

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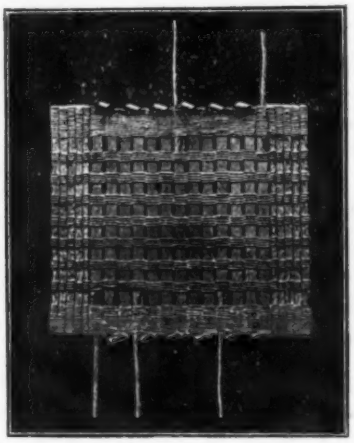

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TENDERS are invited up to JULY 11th, 1921, for the supply and delivery to the Postmaster-General's Department, State of Tasmania, of Switchboard Material generally, as per Schedule T 317.

Specifications, tender forms, &c., can be obtained at the Office of the High Commissioner for Australia, Room E 5, Australia House, Strand, W.C. 2. 5976

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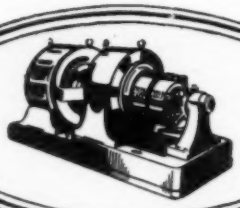

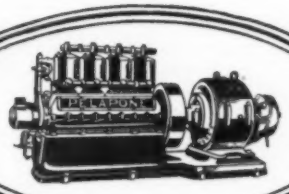

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7/·029	11	13	4	20	10	8
7/·036	16	8	8	28	18	7
7/·044	21	18	1	38	11	2
7/·052	29	3	2	51	6	5
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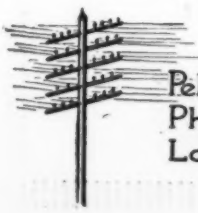

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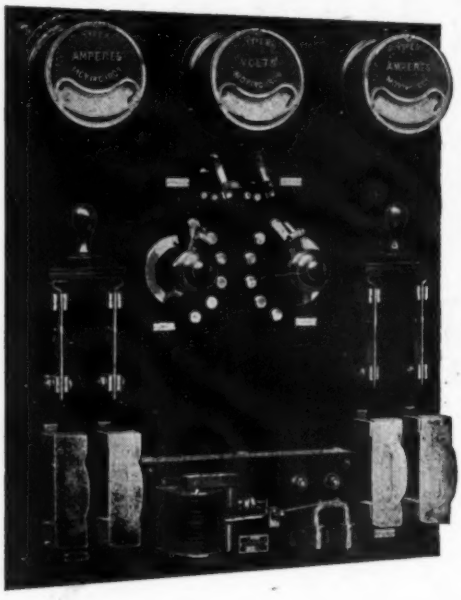

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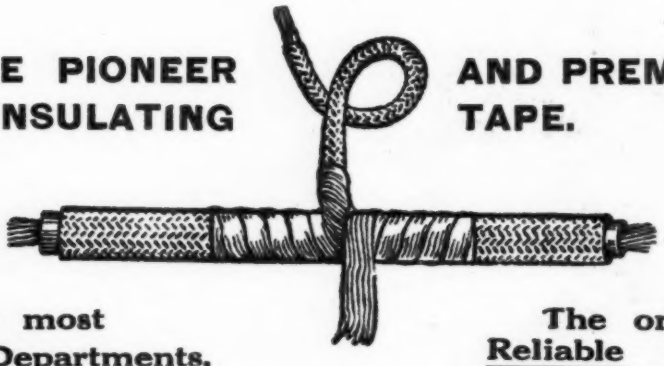

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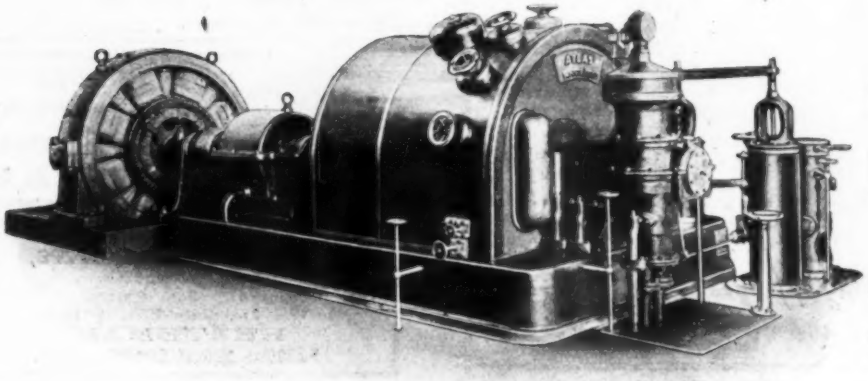

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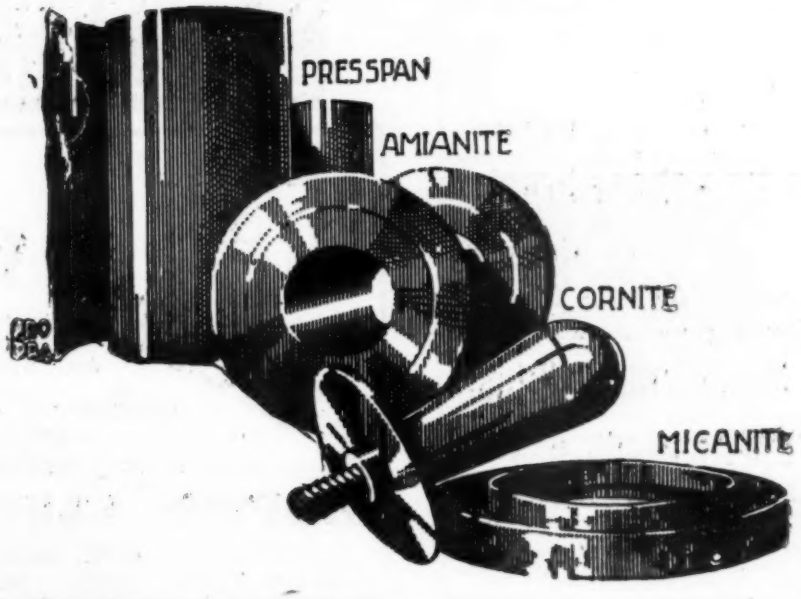

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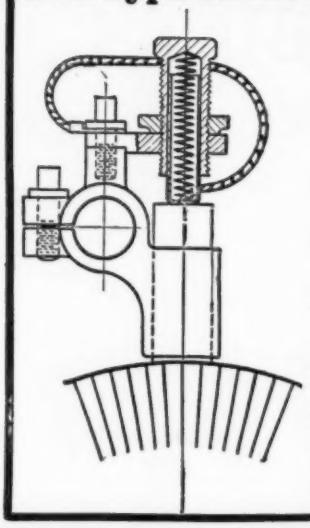

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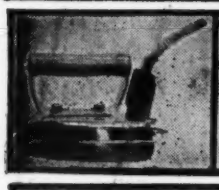

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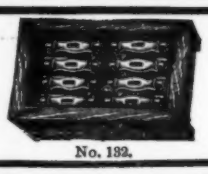

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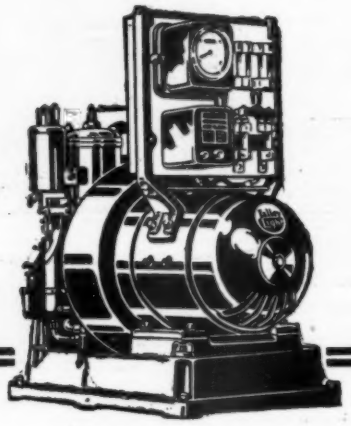

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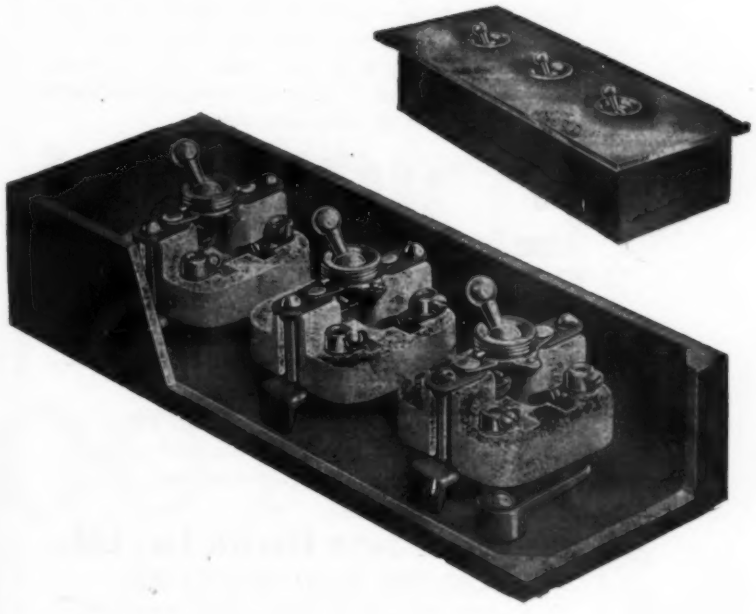

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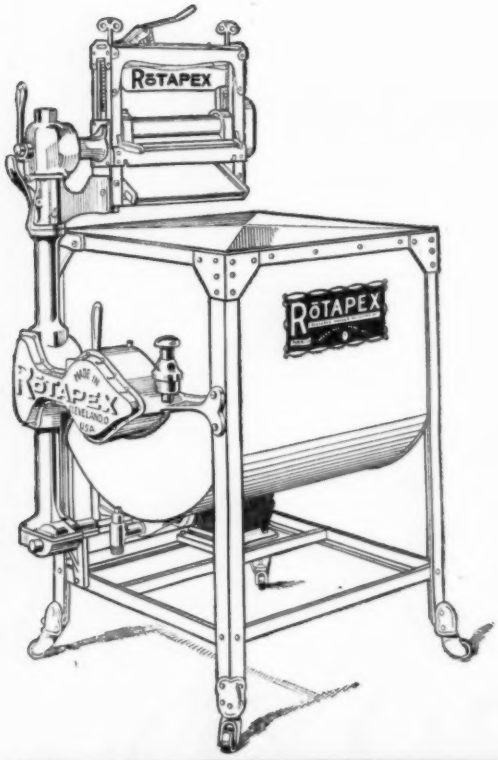

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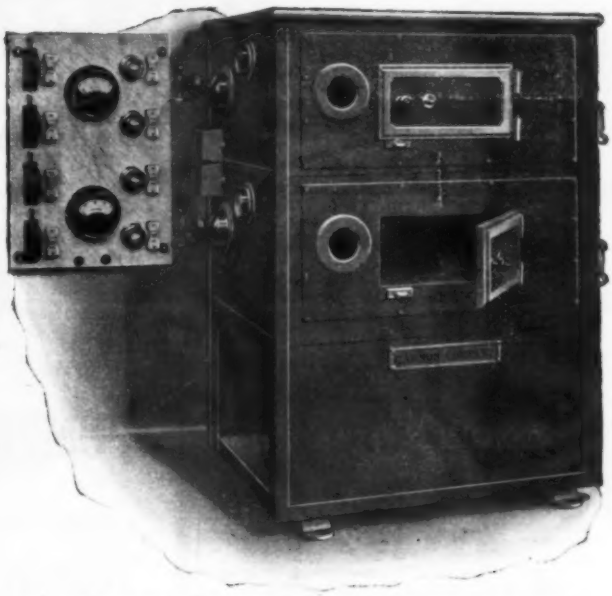

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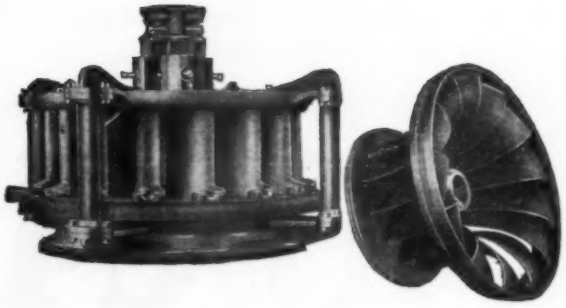

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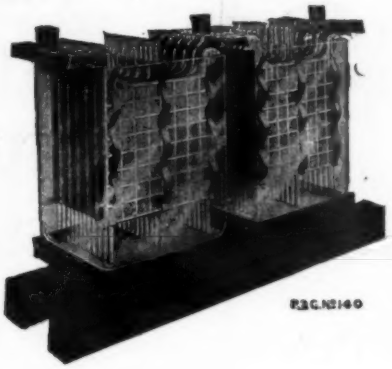

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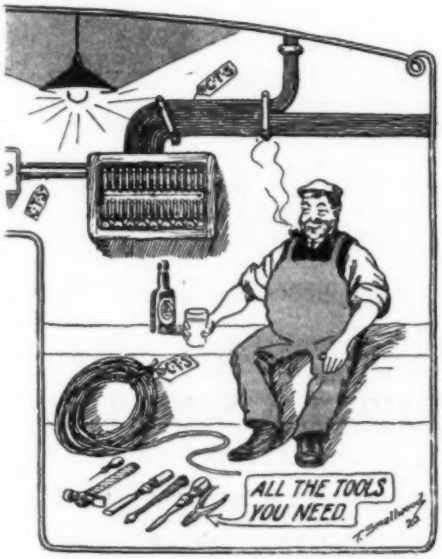

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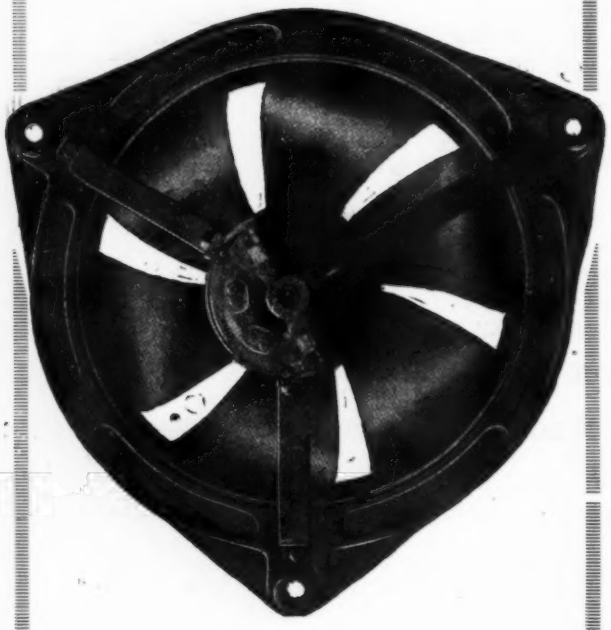

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CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Alterations to Oldmill Hospital; Architect, H.M. Office of Works, 2, Parliament Square, Edinburgh.

BENMHLL.—Detached house in Belle Hill; G. H. Gray, Sea Road. Detached house in Richmond Road, detached residence, Westville Road, three detached houses, Warwick Road; J. E. Maynard, Collington Avenue. Three detached houses in Collington Avenue; G. E. Mathews, Collington Avenue. Detached bungalow in Jameson Road; F. Smee, Jameson Road. Conversion into flats two houses, West Parade; J. B. Wall, Devonshire Road.

BANGOR (Co. Down, Ireland).—Baptist church; Rev. D. Burrows, pastor.

BANGOR.—34 houses, for Ogwen R.D.C.; J. Hughes Roberts, clerk to the Council, Tanyfynwent Offices.

BIRCHINGTON (Thanet).—Conversion of "The Hall" into orphanage, for the directors of Spurgeon's Homes, London.

BIRKENHEAD (Heswall).—Extension of police station, for County Standing Joint Committee; H. Beswick, County Architect, Chester. Showrooms, &c., for J. G. Edwards, motor engineer, Trinity Street.

BLACKPOOL.—Club house, for the Blackpool North Shore Golf Club; J. K. Stead, secretary.

BOLTON-UPON-DEARNE (Yorks.).—Alterations, Angel Hotel; Newbald & Hartley, architects and surveyors, 1, Barstow Square, Wakefield.

BOSTON.—Conversion of Norton House into tuberculosis hospital (£6,000), for Hollands C.C.; the clerk.

BURSLEM.—Institute, for Trustees. Hamilton Road Primitive Methodist schools.

CADISHEAD.—Extension of Congregational Church; Rev. W. J. Rees, pastor.

CHESTER.—Memorial hall at Farndon; E. W. Ince, secretary to the Committee, Farndon.

COVENTRY.—Roman Catholic school, Stoke; Rev. J. J. Walsh.

DUMFRIES.—Extensions, for Robinson Bros., drapers.

DUNDEE.—Rebuilding of dressing and pattern shops, Lilybank Foundry, for the Caledon Shipbuilding and Engineering Co., Ltd.

EDINBURGH.—Alterations to Pilton Hospital; H.M. Office of Works, 3, Parliament Square.

FALKIRK.—Warehouses, M. Cockburn's Gowanbank Ironworks, Grahamston (£1,200); the manager.

FIFESHIRE.—Additions, Crawford Priory Mansion House; Lord Cochrane of Cults; Crawford Priory.

GLASGOW.—Model dairy farm for Corporation; city engineer.

GUISBOROUGH (Yorks.).—24 houses, for the U.D.C.; H. Kilburn, surveyor.

HEMSWORTH (Yorks.).—30 houses, Hemsworth-Highfield (No. 2) Housing Scheme; W. T. Lynam, architect, Council Offices.

HEYWOOD.—88 houses, Barley Hall site; J. T. Proffitt & Sons, architects, Memorial Road, Walkden, near Manchester.

HUDDERSFIELD.—46 houses, Grove Place site, Long Lane, Dalton; H. Sutcliffe, borough architect, 1, Peel Street.

KING'S LYNN.—30 houses, for the T.C.; borough surveyor.

LEEDS.—Reinstatement, Kirkstall Forge, Ltd.; proprietors.

MOTHERWELL.—Conversion of Wishaw Pavilion into picture house (£3,000); manager, Wishaw Pavilion, Ltd.

MYLOR.—Schools, for the Church of England; trustees.

NEW MALDEN.—Extensions; Pastor, Congregational Church.

NORTHAMPTON.—Warehouse, Newland, for Berridge Bros., wholesale dry-salters.

OAKHAM.—Alterations to the elementary schools; managers.

OLDHAM.—Sorting office; District Surveyor, H.M. Office of Works, New Bridge Street, Manchester.

RAINHAM (Kent).—Additions; Pastor, Congregational Church.

RENFREWSHIRE.—Rebuilding Southbar Mansion House; R. Sutherland, Southbar, Erskine Ferry.

RUGELEY.—Housing scheme; surveyor to U.D.C., Council Offices.

RYDE (Havenstreet).—Alterations to Longford House, with electric light work, for the Isle of Wight C.C.; S. R. Cocks, county surveyor, St. Thomas Street.

SEVENOAKS.—21 houses, for the R.D.C.; P. F. Potter, architect, 49, London Road.

SHEFFIELD.—Kinema theatre; P. A. Hinchliffe, architect, 14, Regent Street, Barnsley.

SKYE.—Mansion House at Skaebost, Skye, for Duncan MacLeod, whisky blender, Glasgow.

TAUNTON.—74 houses, for the T.C.; I. F. Shellard, borough engineer.

TEDDINGTON.—Works, for the Vinora Cabinet Works, Munster Road; Mr. Breading, owner (£10,000).

THORNTON (near Blackpool).—Additions to Mission Church, Heys Street; Rev. C. N. Sergeant.

TODMORDEN (Yorks.).—Reinstatement, Todmorden Motor Co.; H. Simpson & Co.

WAKEFIELD.—Remodelling of Agbrigg sewage disposal works; borough surveyor. Warehouse in Gill's Yard and Strafford Square, for Kilkenny Bros. Extension at economiser works, Calder Vale Road, for E. Green & Son.

WALSALL.—Additional pavilion at Pelsall Hall Sanatorium; borough surveyor.

WEST HARTLEPOOL.—Alterations to warehouse, for North-Eastern Railway Co.; A. Pollard, architect, York.

WHITBY.—Residence, Carr Hill Lane, for Rev. Philip Drewitt; A. E. Young, architect.

WITNEY (Oxon.).—Extensions, for the trustees of the Wesleyan Church.

WREXHAM.—Adaptation of premises in Grosvenor Road as offices, clinic, &c., for Denbighshire Education Committee; county architect.

YORK (Whixley).—Houses and farm buildings; County Land Agent, County Hall, Wakefield.

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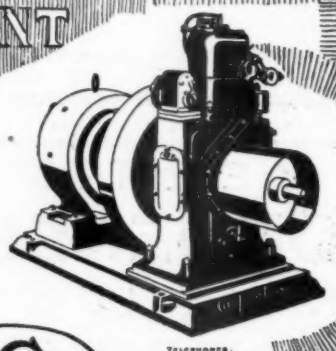

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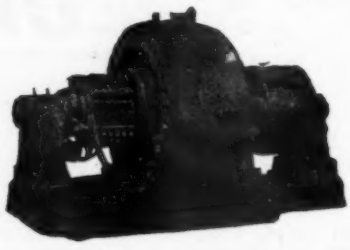

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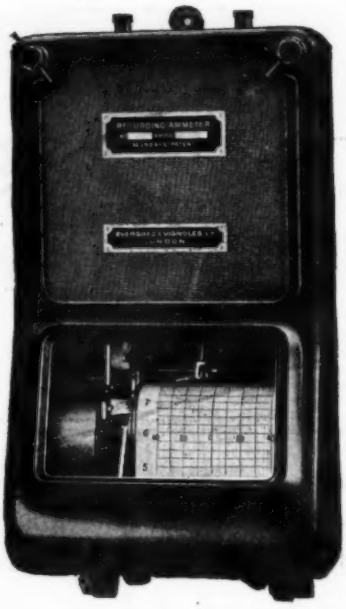

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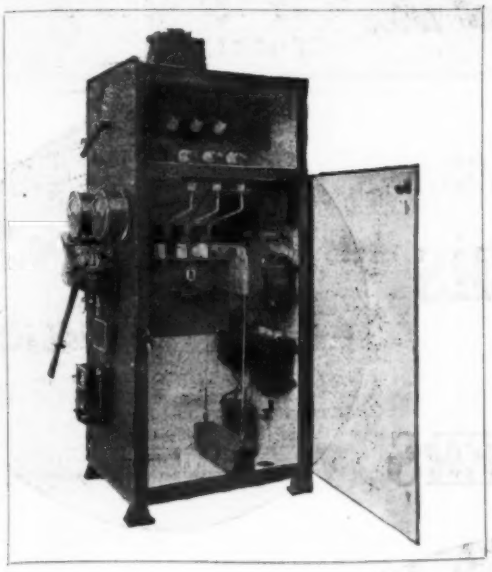

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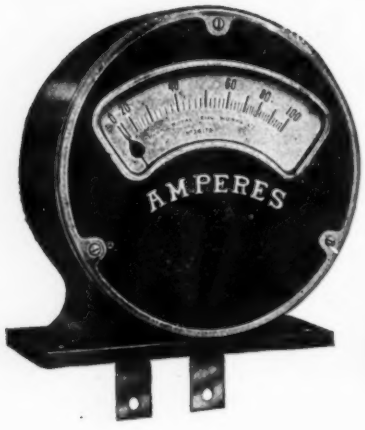

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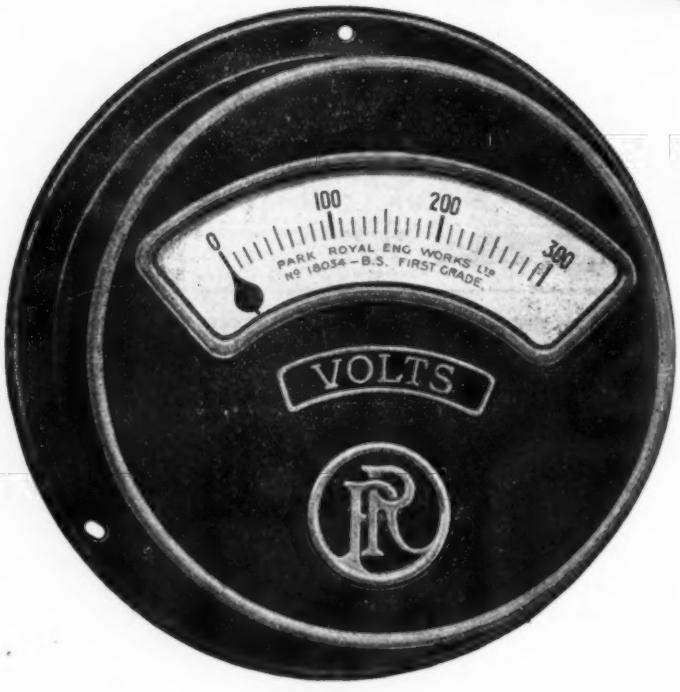

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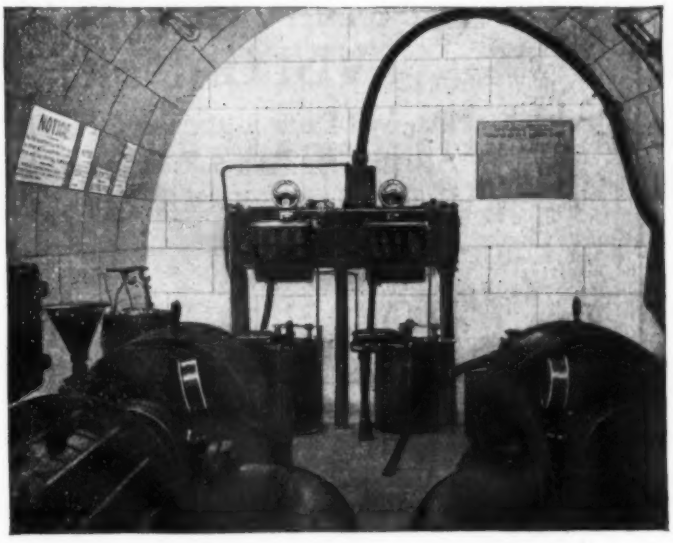

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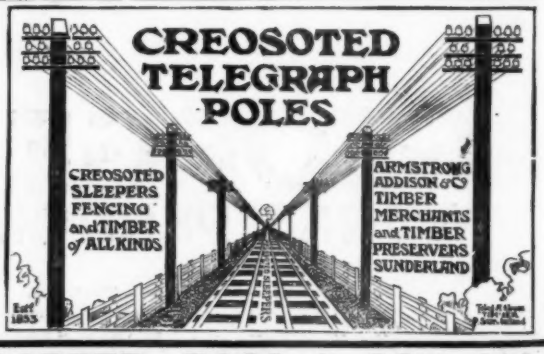
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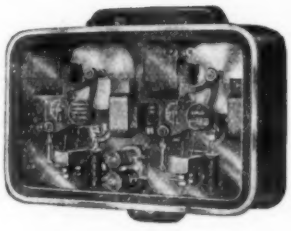

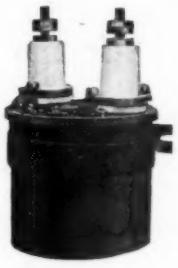

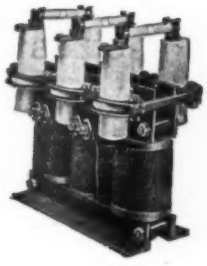

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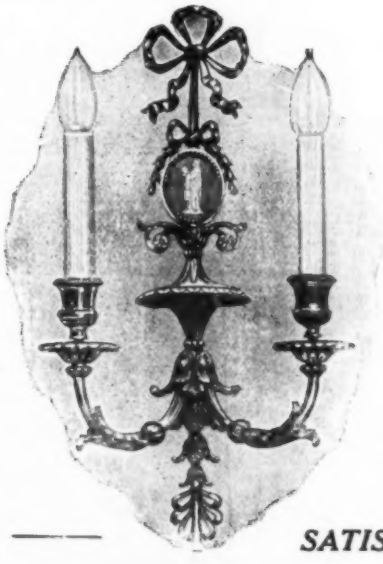

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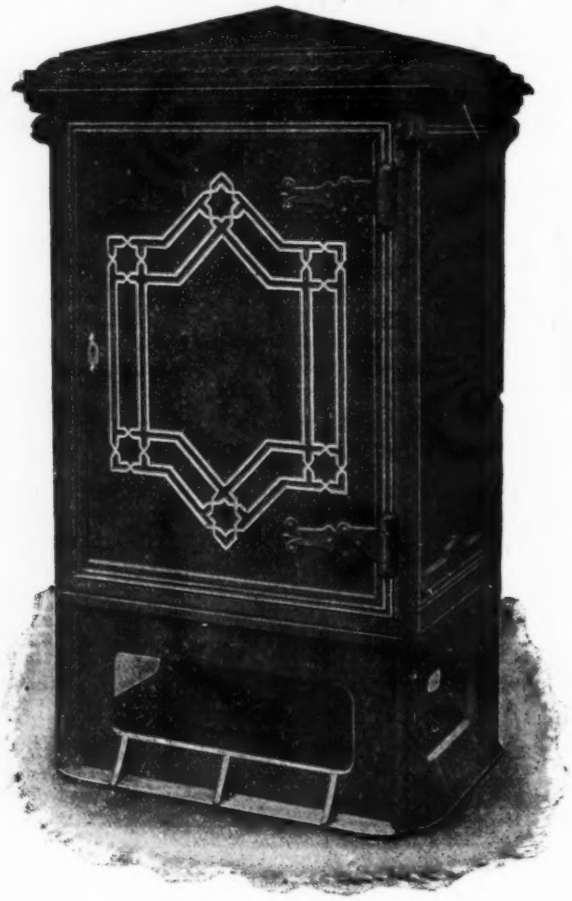

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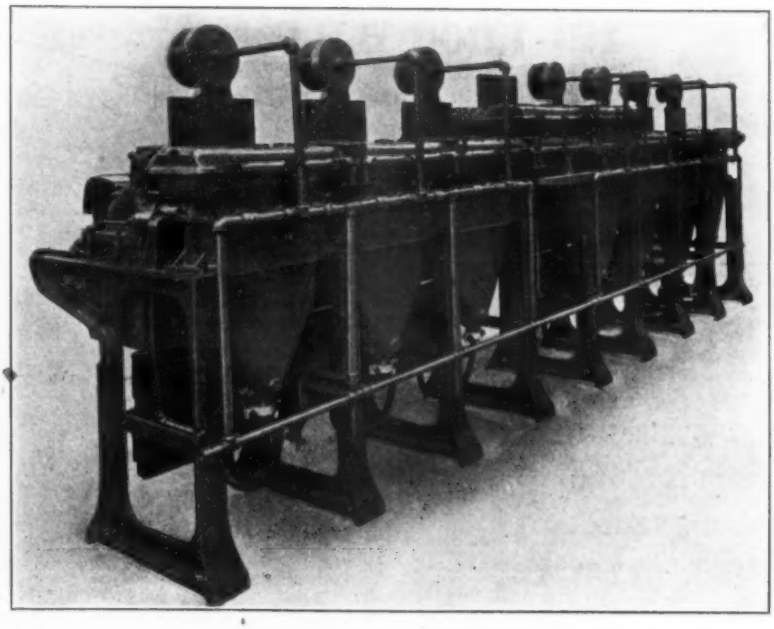

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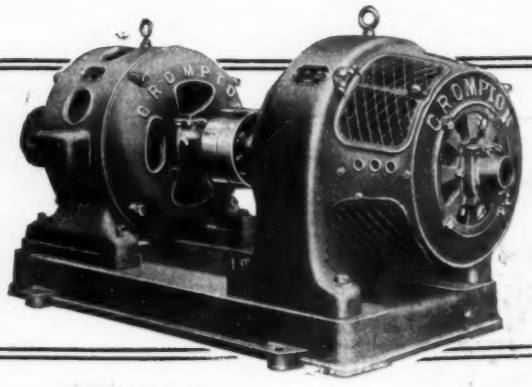

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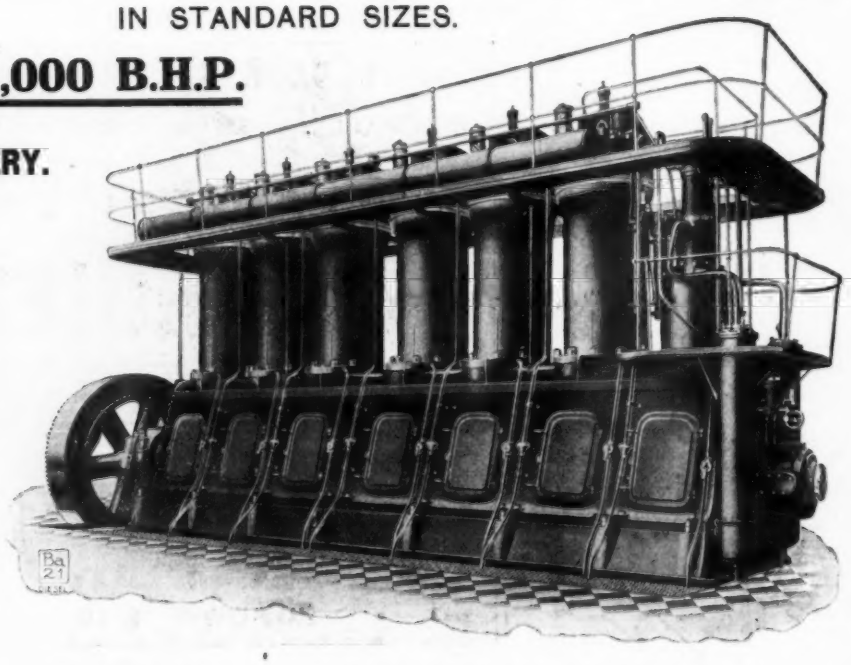

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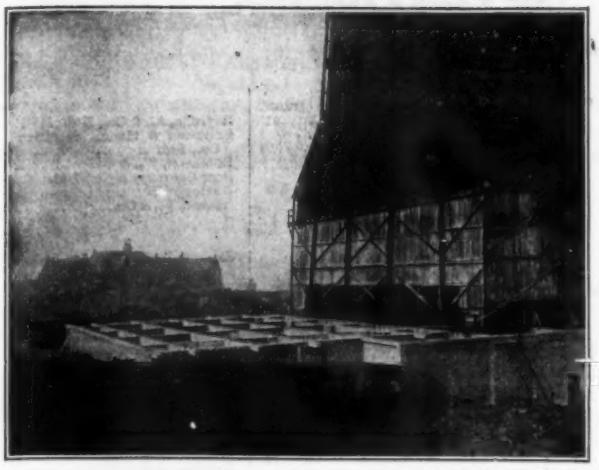

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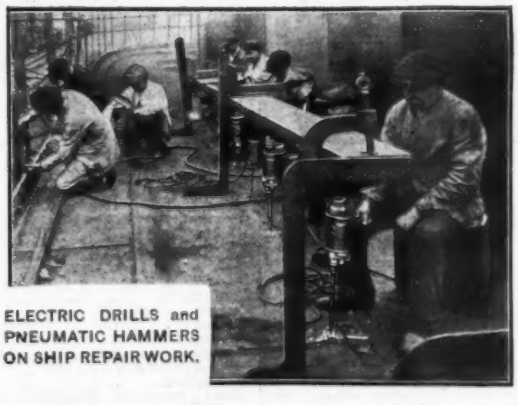

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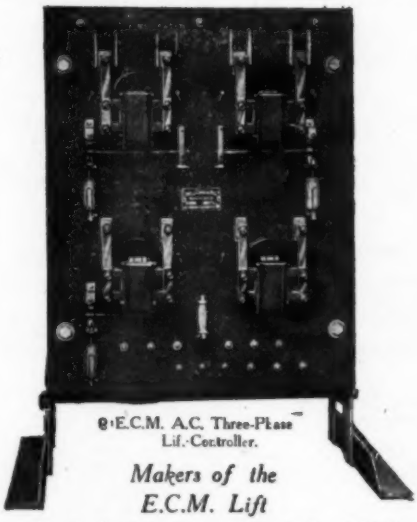

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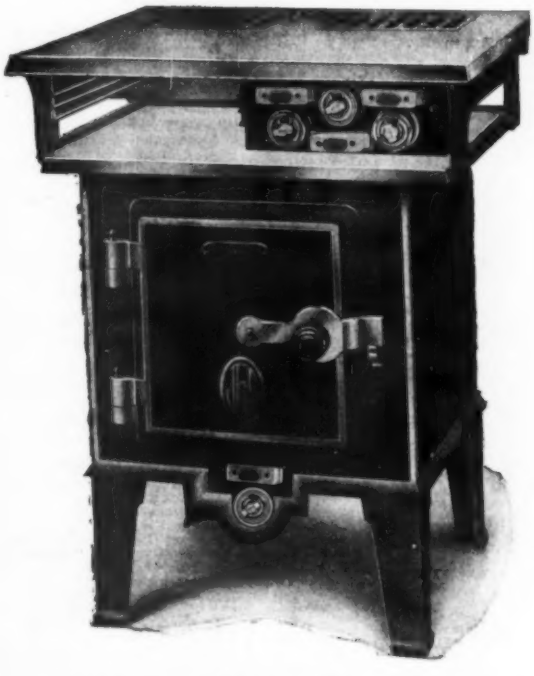

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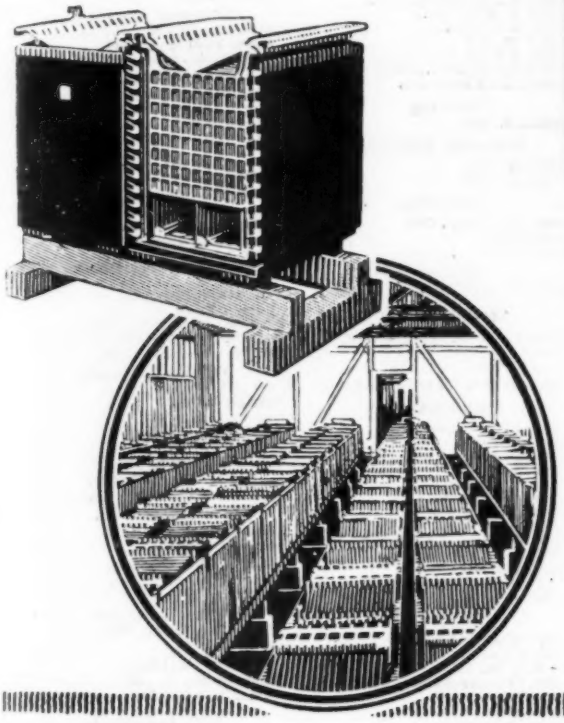
(Continued on page xliv.)



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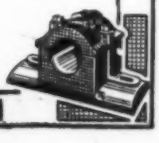

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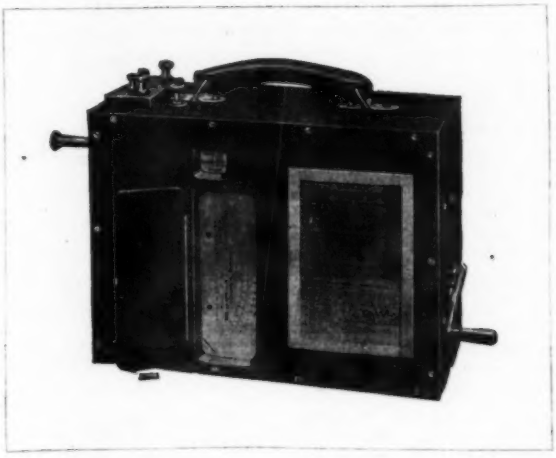

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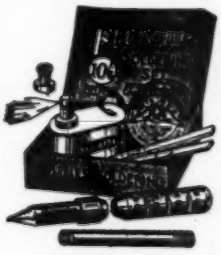

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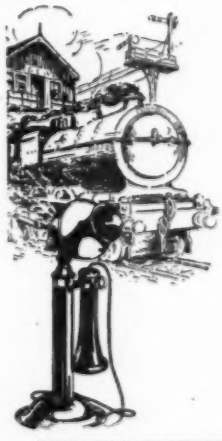

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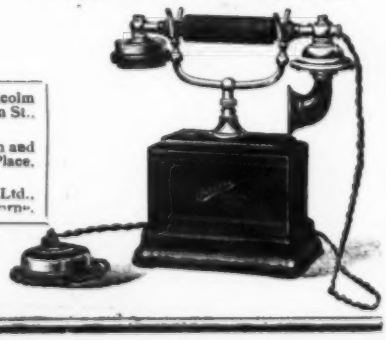

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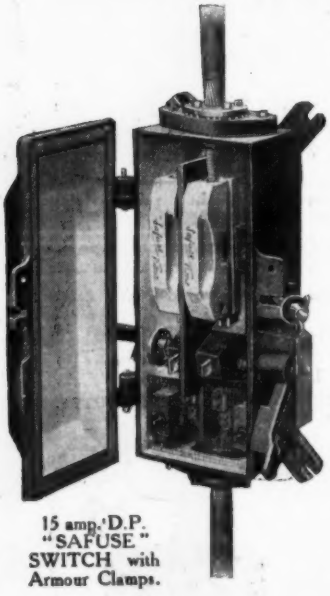

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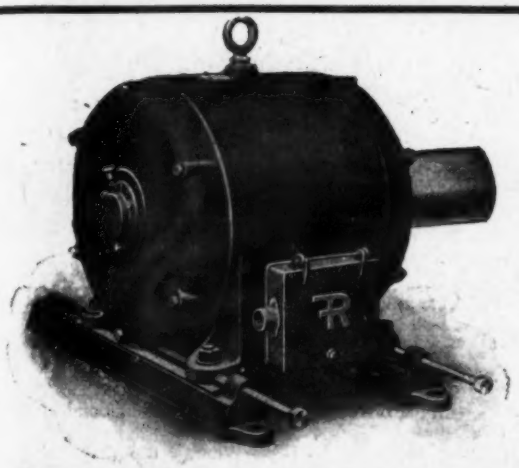

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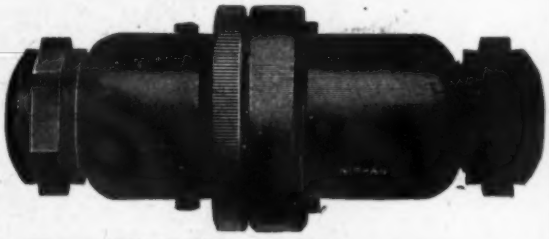

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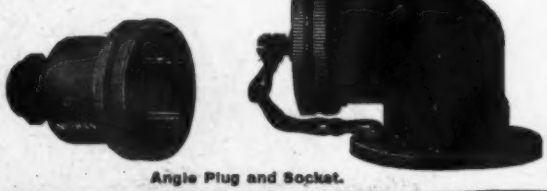

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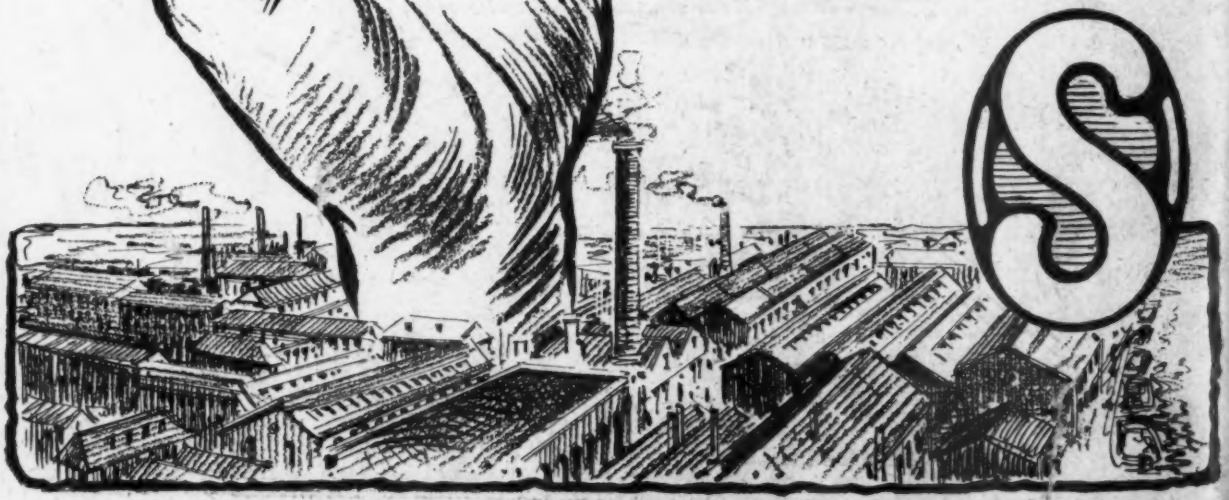

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